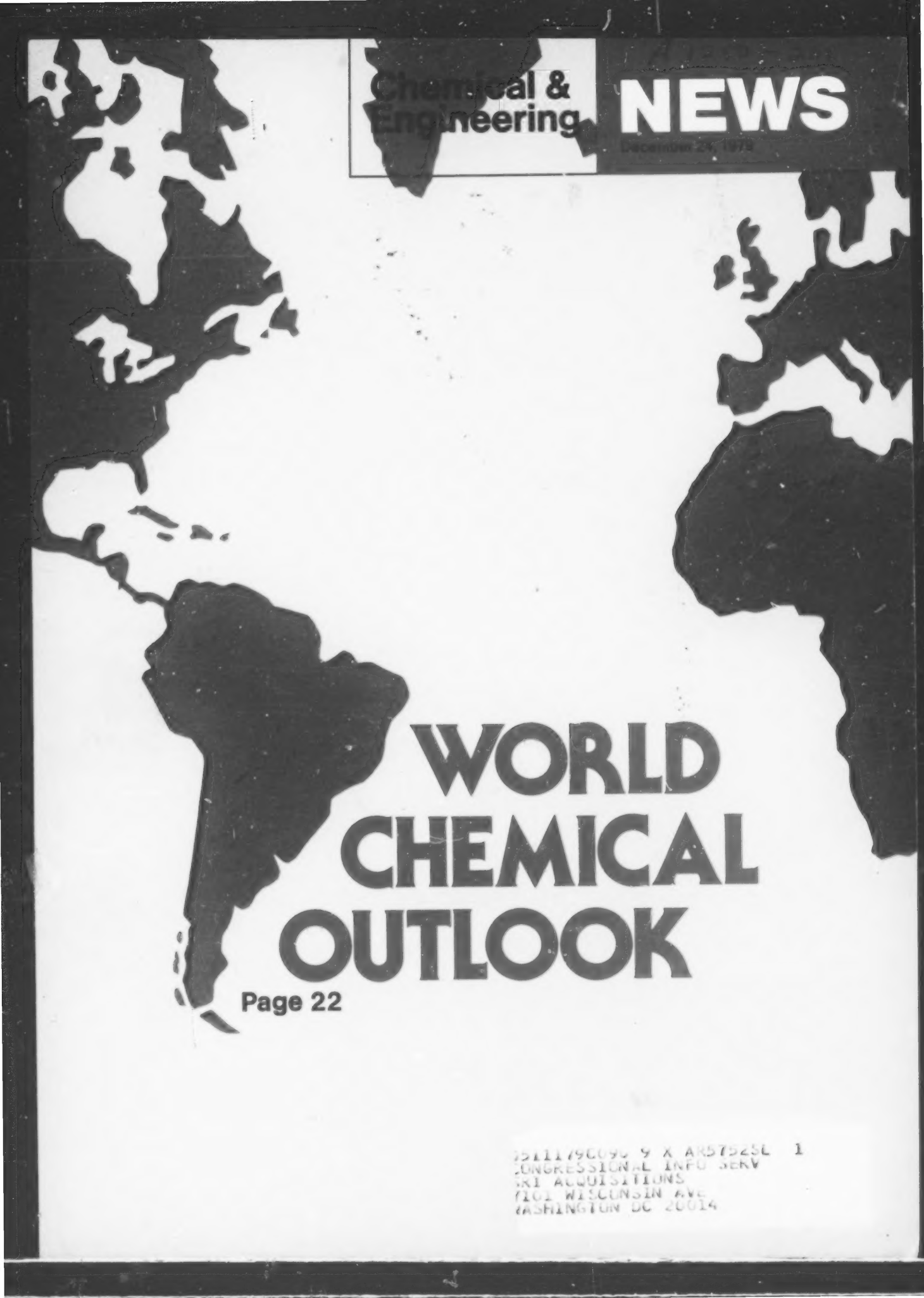


A stylized world map is shown in the background, with continents represented by solid black shapes against a white background. The map is centered on the Atlantic Ocean.

**Chemical &
Engineering**

NEWS

December 24, 1979

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News of the Week

- **Suits seeking cleanup and monitoring** at chemical waste dumps in Niagara Falls, N. Y., have been filed against Hooker and Occidental. **Page 4**
- **R&D spending in the U.S. will rise** about 7% in 1980 in constant dollars to a record \$61.8 billion, forecasts Battelle. **Page 4**
- **First in series of science and technology studies** with a rolling five-year outlook, funded by the National Science Foundation, has been published. **Page 5**
- **Fourth-quarter earnings at Cyanamid** will be about \$44.5 million—little more than the same period in 1978—or about 93 cents a share. **Page 5**
- **Recent diabetes research** in autoimmunity with animal models may boost experimental treatment of human juvenile-onset diabetes with immunosuppressant drugs. **Page 6**
- **Demand for chemists graduating next June** will be up only modestly in 1980; starting salaries will rise, but won't keep pace with inflation. **Page 6**

Business

- **Survey of chemical company pension plans** finds that they are in safer financial shape and are more generous than those of U.S. industry as a whole. **Page 6**

Government

- **S. David Freeman, chairman of TVA**, has increased the utility's emphasis on renewable energy resources, and would like TVA to be national lab for energy. **Page 6**

Science

- **DNA can form a left-handed helix** is the surprising finding of MIT scientists doing x-ray studies on small G-C sequences; configuration may give clues to how DNA reacts with other molecules. **Page 14**
- **Women scientists are making gains** with respect to their male counterparts in receiving equal status and pay, but several studies indicate that there are still many differences to be resolved. **Page 15**

Education

- **Trial has begun in the case** of alleged plagiarism by Solomons of material from the organic chemistry textbook of Morrison and Boyd; each side as distinguished chemists to testify for them. **Page 18**
- **Industrial chemists are teaching analytical chemistry** in VPI program aimed at providing an overview of industrial applications not covered in conventional courses. **Page 20**

World Chemical Outlook

- **The world chemical industry is closing its books** on a year that was both busy and profitable, but soaring feedstock and energy costs, slackening demand, and increasing competition cloud the outlook for the year ahead. **Page 22**

Books

- **Chinese science policy** and how it is progressing is described by U.S. delegation that visited China last year. **Page 48**



WORLD CHEMICAL OUTLOOK

More and more, the world's chemical industry is becoming integrated and closely knit. That this is true shows up clearly in this latest edition of C&EN's annual report on the outlook for the industry during the year ahead.

The rising cost of petrochemical feedstocks and energy, which in large part reflects continuing political turmoil in the Middle East, has driven up the expense of producing chemicals everywhere in the world. Nowhere is this more evident than in the price Western European petrochemical producers must pay for their basic raw material, naphtha.

At the same time, U.S. producers are enjoying a distinct cost advantage, at least currently, with

hydrocarbon raw materials produced within this country. Couple this with the additional advantage of a dollar that is relatively weak compared with most other world currencies, and the upshot is a more strongly competitive position for U.S.-bred chemicals in markets throughout the world. The consequent rise in U.S. exports has provided a cushion for U.S. industry during a time when domestic demand has shown signs of slackening, even as it has caused consternation elsewhere.

Meanwhile, more and more countries are striving to develop a home-grown chemical capability. In Latin America, Mexico and Brazil already are factors to be reckoned with in world



chemical production. The Soviet Union and its Eastern European allies are aggressively seeking a place in the world chemical sun. Although their impact will be further in the future, China and the oil-producing countries of the Middle East are laying ambitious plans. Industry planners will ignore them only at increasing risk.

All in all, the year now closing basically has been a good one—in terms of production, sales, and profits—for the world's chemical industry. But now, with the U.S. apparently slipping into a business recession, industry executives everywhere are cautious. An economic slowdown in the U.S. probably would have an immediate impact on nearby neighbors like Canada and Mexico. But its effects could ripple across the economies of the rest of the world as well.

Burdened as it is with fast-rising raw material costs, more slowly growing demand, and increasing competition, the world's chemical economy probably is more fragile than last year's buoyant record might suggest.

United States	24	Canada	40
Foreign Trade	27	U.S.S.R./Eastern Europe	42
Western Europe	30	China	44
Japan	34	Middle East	46
Latin America	37		

United States



Chemical firms face business slowdown in 1980

The year now ending has proved to be much better for the U.S. chemical industry than generally had been expected 12 months ago. Then, the outlook for 1979 looked decidedly bumpy. Many economists were predicting that the U.S. would slip into a recession sometime before year's end—and probably before midyear. As a result, output of chemicals was expected to show little, if any, growth and profits to stagnate. In fact, many Wall Street observers were looking for a marked drop in chemical companies' earnings, on the average.

It didn't turn out that way at all. This month closes a year that was fundamentally strong for the chemical industry. Production is higher almost across the board. And with selling prices marked up repeatedly throughout the year, dollar sales have surged. For the year as a whole, sales for producers of basic chemicals, plastics, and fibers probably will top those of 1978 at least 20%. Profits, meanwhile, are running well ahead of the previous year. For the first nine months of 1979, they were about a third higher; for the entire year the gain will be nearly as much. It has been a particularly robust year for export markets. Plastics also have done well.

Industry executives, meanwhile, seem to remain optimistic, if cautiously so, about the 12 months immediately ahead. But if 1979, in retrospect, came up much more of a winner than had been forecast, 1980 may well prove more troublesome than many now think.

Economists, for one thing, are nearly unanimous in predicting a recession for 1980, with the consensus expecting a moderate decline extending at least into summer, to be followed by a rebound during the final months. Many economists are convinced, indeed, that the weight of the evidence indicates a business de-

The surge in sales and profits which the chemical industry enjoyed this year is unlikely to be repeated in the next 12 months

David M. Kiefer, C&EN, Washington

cline already is under way. The prestigious economic forum of the Conference Board states flatly, for example, that "the U.S. economy is in the grip of recession and it will run into the summer of 1980." The forum, made up of 12 economists and business analysts, projects real (adjusted for inflation) gross national product will fall 1.7% in the current three months, 1.8% in the first quarter of 1980, and 0.5% in the second quarter before recovering slowly during the year's second half. For 1980 as a whole, it forecasts a decline in real GNP of 0.4%, after a 2% rise this year.

Other economists are even more pessimistic. The Business Council, for instance, looks for a decline of 1.2% for all of 1980 in the total output of goods and services, after adjusting for price changes. Others think that 1980 will witness a year-to-year drop of 2 to 2.5% in real GNP.

The economic experts have been wrong in the past, to be sure—notably during the past 12 months, when

predictions of impending recession have been persistently premature. Calling the turn of a business cycle has never been easy. Even now, the signals are by no means clear. The rate of unemployment shows no sign of rising; at 5.8% of the nation's labor force in November, it has held essentially unchanged for more than a year. Retail sales, too, are holding up, setting an all-time high of \$77 billion last month. These and other indications of continuing economic strength are convincing some prognosticators that the economy is due for nothing worse in 1980 than a period of weaker, but lingering, growth.

One thing is clear nevertheless. Economic expansion already has slowed quite perceptibly from what it was in 1977 and 1978. Industrial production, for example, now is no higher than it was about a year ago; it has been flat all year. This year as a whole is expected to show a rise of about 4% compared to 1978, a gain, however, that may be largely wiped out in 1980.

And some major areas of business already are hurting severely, none more so than the automobile industry. Car sales at present are running about 20% behind what they were a year ago and Detroit has been cutting back drastically on its assembly lines in an attempt to bring badly swollen inventories into line with sales. As a result, about 130,000 auto workers are on indefinite layoffs, with even more likely to be off the job in any given week because of temporary shutdowns. Auto output is estimated to total 8.4 million units this year, down about 8% from 1978. And next year, according to some industry analysts, production is likely to slump again as much as 1 million cars.

Housing is the other major segment of the economy for which near-term prospects are notably gloomy. With mortgage money in short supply and

extraordinarily costly, housing starts are declining. Last year, 2.0 million new housing units were started in the U.S.; this year the total will be about 1.7 million (which is more than most housing experts were predicting at the start of the year). Next year, builders fear, only between 1.2 million and 1.4 million units may be started, and some warn that business may be even worse.

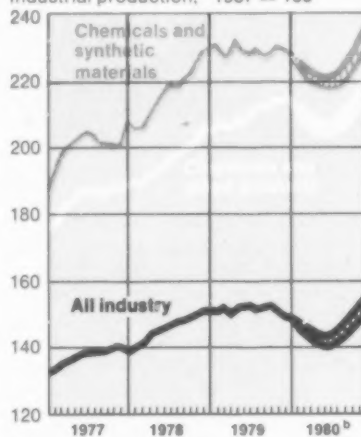
Other forms of construction, although generally holding up better than housing, also are expected to suffer from tight money and high costs. The Department of Commerce, as a result, forecasts that construction spending next year will be virtually the same as the \$222.5 billion it estimates will go into new construction this year. However, that will mean that the physical volume of building will be 9 to 10% less.

The current weakness in autos and housing is sure to spread to other industries. Steel production, for one, probably will fall about 10 million tons in 1980 from this year's expected output of close to 100 million tons. Tire production, probably down 9 to 10% this year, is likely to be hit by a similar decline in 1980. Household appliance shipments are expected to decline 4 to 5%, actually a decline of 11 to 13% after factoring out the impact of higher prices. Textile production probably will hold up better next year than often has been the case during past recessionary periods, such as 1974-75, thanks in part to the absence of inventory excesses and relatively good export demand. Nevertheless, industry experts see textile mill activity easing about 2% from this year's levels.

Nor will the chemical industry be immune. Autos, housing, appliances, tires, and textiles are among the major outlets for plastics, fibers, rubber, coatings, and other products turned out by the industry. Any

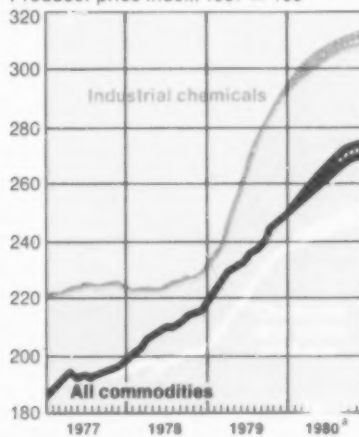
Production is likely to slump, ... but selling prices will then rebound, next year ...

Industrial production, ^a 1967 = 100



^a seasonally adjusted. ^b C&EN estimates. Source: Federal Reserve Board

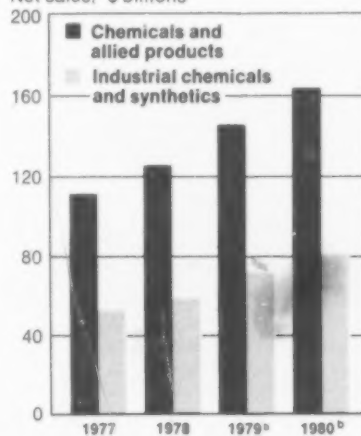
Producer price index, 1967 = 100



^a C&EN estimates. Source: Bureau of Labor Statistics

... giving another boost to sales volume ...

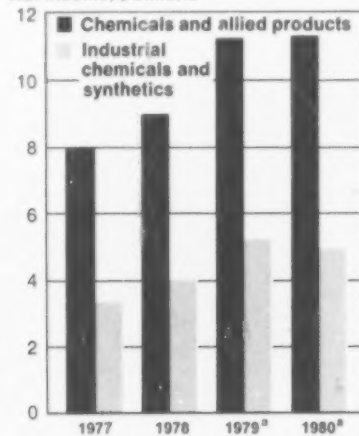
Net sales, ^a \$ billions



^a Excludes sales of foreign subsidiaries. ^b C&EN estimates. Source: Federal Trade Commission

... while profits fail to keep pace

Net income, \$ billions



^a C&EN estimates. Source: Federal Trade Commission

Little or no growth likely in production of most chemicals next year

	1977	1978	1979	1980
INORGANIC CHEMICALS (Thousands of tons unless otherwise noted)				
Ammonia	17,576	16,967	17,500	18,000
Chlorine gas	10,573	10,959	12,100	11,500
Hydrochloric acid	2,721	2,751	2,900	2,700
Nitric acid	7,951	8,061	8,500	8,200
Oxygen, billions of cu ft	393	428	430	450
Phosphoric acid	8,958	9,563	10,100	10,500
Sodium hydroxide	10,933	10,746	12,200	11,900
Sulfuric acid	35,821	39,857	41,800	40,500
ORGANIC CHEMICALS (Millions of lb unless otherwise noted)				
Acetic acid	2,570	2,776	3,200	3,000
Acetone	2,219	2,052	2,400	2,300
Acrylonitrile	1,646	1,752	2,000	2,100
Benzene, millions of gal	1,436	1,488	1,650	1,550
Butadiene	3,259	3,515	3,500	3,200
Cumene	2,644	3,380	3,600	3,500
Cyclohexane	2,265	2,332	2,400	2,300
Ethylene	25,426	25,955	29,500	31,000
Ethylene glycol	3,675	3,904	4,400	4,400
Formaldehyde	6,046	6,381	6,450	6,200
PLASTICS (Millions of lb)				
Polyethylene, high-density	3,652	4,201	5,000	5,400
Polyethylene, low-density	6,471	7,111	7,700	8,200
Polypropylene	2,747	3,074	3,900	4,400
Polystyrene	3,446	3,823	4,000	4,100
Polyvinyl chloride	5,253	5,723	6,100	6,300
SYNTHETIC FIBERS (Millions of lb)				
Acrylic and modacrylic	709	726	750	700
Nylon	2,326	2,550	2,700	2,600
Olefin and vinyon	635	692	740	700
Polyester	3,642	3,800	4,200	4,000

Sources: Bureau of the Census, International Trade Commission, Society of the Plastics Industry, Textile Economics Bureau, C&EN estimates (for 1979 and 1980)

weakness in these areas can spill over quickly into chemical operations.

Actually, growth in production of chemicals and synthetic materials has been slowing all year, after having risen stoutly throughout nearly all of 1978. It probably peaked last summer and now is no higher than it was last winter.

For the year as a whole, production of chemicals and synthetics probably will wind up about 7% higher than in 1978. That's a good gain, about equal to what the industry achieved in 1978 and in line with its growth record over the entire past decade. If the current consensus that the U.S. is slipping into a brief and moderate recession proves true, chemical output can be expected to sag as well. For 1980 as a whole, production of chemicals and synthetics is likely to trail this year's level 2 to 3%, although a year from now it probably will be edging once again above its current level.

One factor that has helped to keep production at a high level this year is rising foreign demand for U.S.-made chemicals. Exports of chemical products will be about a third higher this year than they were in 1978, rising to about \$17 billion. Relatively low petrochemical feedstock costs have given U.S. producers of organic chemicals, plastics, and fibers a competitive advantage over producers in Europe and Japan, where naphtha prices, for example, have been soaring. U.S. industry officials are hopeful that the advantage will hold up again next year, thus pro-

viding a cushion against the slack that will result from lower demand by U.S. customers. That perhaps too optimistic hope rests on the assumption, however, that demand abroad will not be hit by recession, as well.

Export demand has not been the only factor bolstering industry sales this year, however. Higher selling prices have been an even bigger factor. The Bureau of Labor Statistics' index for industrial chemical prices has been rising well over 1% a month throughout 1979, as producers have been compensating for sharply higher costs of energy and hydrocarbon feedstocks. Since plants making many basic petrochemicals and polymers have been running close to capacity in recent months, producers have been in a more favorable position than in the past to push higher costs successfully through to their customers. At present, the BLS index for industrial chemical prices is about 25% higher than a year ago. For the year as a whole, the gain probably will average about 17%. Synthetic resin prices, meanwhile, are now about 30% higher than this time last year, synthetic fiber prices between 10 and 15% higher.

Feedstock costs are bound to rise again next year. So chemical companies will have no choice but to hike selling prices still further, even though reduced demand may moderate the increases, at least during the early part of the year. Even so, prices next year are likely to average about 15% higher than this year.

This means that dollar sales, too, will be higher, whether production declines or not. Sales of chemical companies are likely to be up 20 to 25% this year, a much better showing than had been expected at this time a year ago. Next year, however, the gain may be only half as much.

Earnings are much more difficult to predict. For industrial chemical producers, the combination of higher prices and high plant-operating rates has made the past year unexpectedly profitable. No one expects a replay in 1980. But opinion is divided as to whether profits will hold at this year's high level or whether they will be eroded by a combination of weakening demand and constantly rising costs. The best bet now seems to be that earnings, at least during part of 1980, will compare unfavorably with year-earlier results. For the year as a whole, they are likely to trail 1979 profits about 4 to 6%—perhaps even 10% if recovery is delayed. But a repeat of 1975, when profits of producers of industrial chemicals, plastics, and fibers plummeted nearly 20%, hardly seems in the cards. □

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Foreign trade



U.S. chemical trade surplus widens

The U.S. chemical industry seems poised to jump headlong into a new decade of world trade from a springboard of unprecedented strength.

The industry will be coming off a year in which chemical exports are expected to hit a staggering \$17 billion. The 35% growth of chemical exports in 1979 will be more than 2.5 times the increase in chemical imports, which are likely to rise 13% to \$7.3 billion.

As a result, the last year of the 1970's will give the chemical industry a trade surplus enticingly close to \$10 billion. That's quite an achievement compared to the \$2 billion surpluses that the industry was ringing up when the 1970's began.

But a sound surplus isn't the only weapon chemical exporters will carry

U.S. producers' cost advantages boosted exports in 1979, but uncertainties pose problems for the 1980's

Earl V. Anderson, C&EN New York

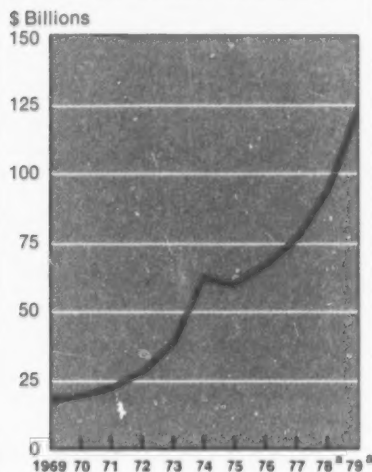
tervailing duties, standards, and customs valuation, is expected to help dismantle some of the nontariff barriers that U.S. exporters face overseas. Tariffs, although no longer the barriers they once were, nevertheless will be lowered on many chemical products.

Government, long considered as much of a hindrance as a help to U.S. exporters, may be providing more assistance. It is reorganizing the federal bureaucracy to put more emphasis on trade.

But the U.S. chemical industry won't be able to waltz into the eighties without its share of trade problems.

Its feedstock advantage, for instance, could be as troublesome as it is advantageous. Already, the European Economic Community (EEC) is

World chemical exports will top \$100 billion this year

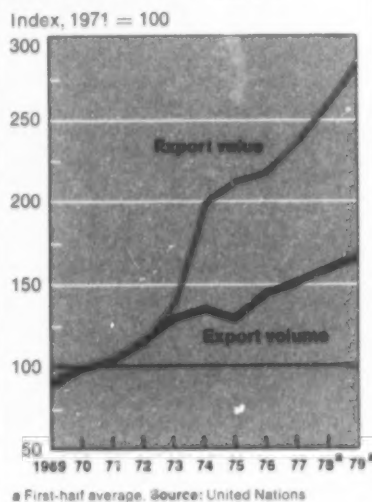


into the eighties. Like many other U.S. industries, the chemical industry is becoming more export-oriented. In more and more chemical companies, top management is becoming tuned in to the potential of exporting.

The industry also likely will enjoy its well-documented feedstock advantage, at least for a few more years. Because of government price controls, petrochemical producers have been able to obtain feedstock at costs well below those of European and Japanese chemical companies. This factor alone played an important role in 1979's strong export performance.

Starting next year, the world's major trading nations will be playing the game with a new set of trade rules—the result of the Tokyo round of multilateral trade negotiations concluded this year. A set of codes, covering such things as government procurement, subsidies and coun-

World exports: value leaps while volume creeps



complaining about the flood of fiber and petrochemical imports entering member countries from the U.S. Calling U.S. oil price controls an "unfair subsidy," European countries want EEC to refer the problem to GATT (General Agreement on Tariffs & Trade). These companies think that countervailing duties should be slapped on these "subsidized imports." EEC already has imposed antidumping duties on American Cyanamid's acrylic fibers.

U.S. chemical exporters are afraid that EEC's action could set a dangerous precedent, one that could set a pattern of action against other U.S. chemical exports. And, even if U.S. chemical companies are able to sidestep this problem, they still have to face the fact that, eventually, their feedstock advantage will disappear as government decontrols oil prices and allows them to rise to world levels.

Although the Tokyo round agreements are history, there still remains the all-important question of how they will be implemented. William S. Sneath, chairman of Union Carbide, calls this "the real test." He sees a number of potential trouble spots and many trade experts echo his concern.

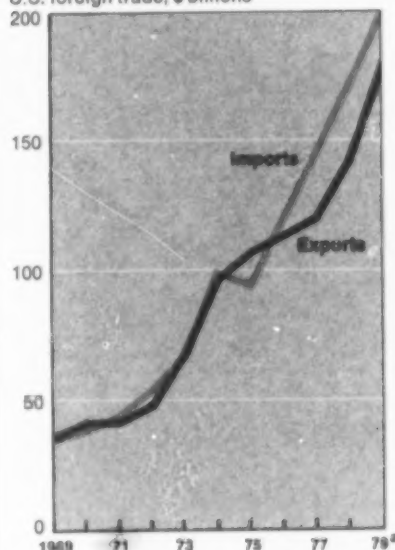
U.S. chemicals find growth markets in developing areas

\$ Millions	1979	1978*
CHEMICAL EXPORTS	\$17,000	\$12,618
Canada	2,003	1,739
Western Europe	5,432	4,275
Eastern Europe	204	62
Japan	1,624	1,104
Communist Asia	107	61
Middle East	366	367
Rest of Asia	2,226	1,324
Latin America	3,696	2,679
Australasia	552	417
Africa	444	349
Other	326	241
CHEMICAL IMPORTS	\$7,270	\$6,427
Canada	2,223	1,805
Western Europe	3,369	3,227
Eastern Europe	104	78
Japan	626	563
Communist Asia	53	34
Middle East	44	41
Rest of Asia	144	124
Latin America	400	312
Australasia	158	115
Africa	45	46
Other	104	82

* C&EN estimates. Source: Bureau of the Census

U.S. trade deficit narrows slightly this year...

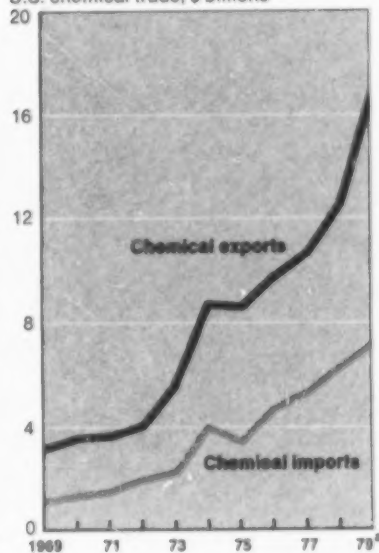
U.S. foreign trade, \$ billions



* C&EN estimates. Source: Bureau of the Census

... as its chemical trade surplus widens a lot

U.S. chemical trade, \$ billions



These same experts wonder about the advantages of the tariff cuts negotiated at the trade talks. They think the cuts will do little to increase U.S. chemical exports, but could do much to increase U.S. imports.

Some problems that lie ahead for U.S. chemical industry in the 1980's are uniquely chemical. Others the industry shares with other segments of U.S. business.

So far, the chemical industry, along with other industries, has enjoyed the advantage that a weak dollar confers on exports. But a weak dollar breeds inflation at home. Investments in plant and equipment falter. Research and development expenditures decline. Productivity lags. None of these developments make for a competitive export industry. And in the 1980's, U.S. exporters will have to be more competitive than ever.

The underlying reason is oil. As oil becomes more expensive, nations that rely heavily on oil imports will emphasize exports as the best way to offset their mushrooming oil import bills. Meanwhile, these nations will try to find ways of reducing other imports. As a result, competition in markets in the developing countries will intensify.

Meanwhile, more products will be entering the world export market from developing nations. This will be particularly true of the so-called "newly industrialized nations," such as South Korea, Taiwan, Singapore, Brazil, and Mexico. Toward the end of the eighties, competition from Middle Eastern oil-producing nations

could become a new threat to chemical exporters.

In the 1980's U.S. exporters also will have to face even more competition from foreign, government-owned companies. These companies don't operate under the same rules that privately owned U.S. companies do.

To them, profits usually are not the primary consideration. Heavily subsidized and supported by government, their objective often is to keep unemployment low. Social issues are the big concern. And to keep their plants operating, state-owned companies attack export markets with prices a U.S. company can't match.

Government-owned companies aren't new. But they multiplied in the 1970's, and no doubt there will be more of them in the eighties.

Saving jobs in faltering industries is perhaps the major reason for the formation of state-owned companies, but it is not the only one. They help diversify a country's industrial base, stimulate domestic economic growth, and often are the only way a country can support high-risk ventures. Such reasons will be as valid in the eighties as they were in the seventies.

The U.S. chemical industry isn't the only one that will face such competition. About 55% of the steel production in noncommunist countries is owned outright by governments. State ownership is mounting in telecommunications, gas and oil, aluminum, and shipbuilding, to name a few.

But the chemical industry already is feeling the pressure. An estimated

35% of the world's low-density polyethylene capacity is controlled by state-owned companies. About a fourth of its capacity for ethylene oxide and derivatives also is controlled by them. According to one estimate, firms owned or controlled by foreign governments will provide the U.S. chemical industry with 50% of its export competition in petrochemicals, plastics, and fertilizers.

In the face of all this competition, the U.S. will be trying to increase its own exports to reduce its staggering balance of trade deficit. Throughout the seventies, that trade deficit ballooned to a cumulative \$76.7 billion. No doubt, the chief culprit was the skyrocketing price of imported oil.

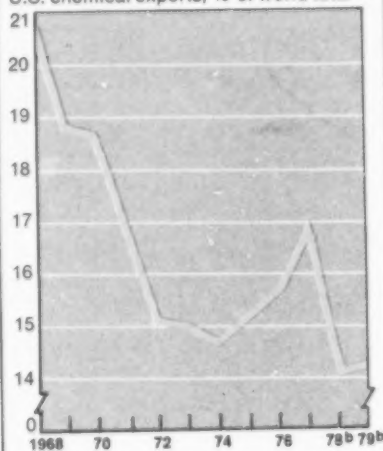
But it would be a mistake to blame the country's faltering stance in international trade on oil alone. And it may be worthwhile to take a long look back at the cause of the U.S.'s persistent trade problems.

According to many trade experts, the U.S. pursued an outdated international economic policy that lasted one decade too long. After World War II, U.S. policymakers focused, not on reparations, but on restoring Europe and Japan to economic health. Rightfully so. As no other nation before it, the U.S. used international economic policy to foster growth in other parts of the world.

World trade was an essential ingredient for this growth. Recognizing this, the U.S. embraced a liberal trade policy, orchestrated the world's leading trading nations into GATT, and established exchange rates that would stimulate the exports of other countries. Economic consequences weren't considered.

U.S. share of world exports remains at 10-year low

U.S. chemical exports, % of world total ^a



^a Defined as U.S. exports as per cent of world chemical exports less U.S. imports. ^b C&EN estimates. Sources: United Nations, Bureau of the Census

Huge cost of imported petroleum. . .

U.S. petroleum imports	1979 ^a	1978	1977	1976	1975	1974
All petroleum products						
Volume (millions of bbl)	3080	2970	3183	2646	2186	2231
Value (\$ millions)	\$52,660	\$39,526	\$42,368	\$32,226	\$25,197	\$24,668
Unit value (\$ per bbl)	\$17.10	\$13.31	\$13.31	\$12.18	\$11.53	\$11.06
Crude and partly refined petroleum						
Volume (millions of bbl)	2515	2399	2540	2066	1661	1466
Value (\$ millions)	\$42,800	\$32,232	\$33,910	\$25,653	\$19,293	\$16,546
Unit value (\$ per bbl)	\$17.02	\$13.44	\$13.35	\$12.42	\$11.62	\$11.29

. . . spoils an otherwise strong U.S. trade position

\$ Millions	1979 ^a	1978	1977	1976	1975	1974
Total U.S. exports						
Fuels exports ^b	5,300	3,878	4,184	4,226	4,465	3,442
Total exports without fuels	\$174,700	\$139,697	\$116,966	\$110,581	\$102,665	\$94,466
Total U.S. imports						
Fuels imports ^b	59,000	42,105	44,537	33,996	25,476	25,427
Total imports without fuels	\$145,000	\$129,921	\$103,148	\$86,681	\$69,640	\$74,824
Actual trade balance	-\$20,000	-\$28,451	-\$26,535	-\$5,870	-\$11,014	-\$2,343
Trade balance without fuels	\$29,700	\$9,776	\$13,818	\$23,900	\$33,025	\$19,642
Petroleum imports as a % of total imports	26.3%	23.0%	28.7%	26.7%	26.2%	24.6%

^a Full year, estimated from 10-month data. ^b Mineral fuels and related materials (SITC section 3). Exports are primarily coal. Difference between values of fuels imports and exports of "all petroleum products" is primarily value of natural gas. Source: Bureau of the Census

In retrospect, say some trade analysts, the U.S. remained wedded to a policy that events have long outdated. By the end of the fifties, European and Japanese industries were producing with new and efficient plants. They once again had become significant factors in world trade. The U.S. share of world trade, as high as 50% at the start of the 1950's, dropped to 30% by the end of the decade.

But in 1958, when European currencies were made convertible, exchange rates were established that continued to overvalue the dollar. Overseas, U.S. exports ran up against a maze of nontariff barriers.

In the early 1970's, the consequences of this outdated international economic policy became apparent. The U.S. balance of trade surplus began to erode. In 1971, and again in 1972, it slipped into deficit. With the exception of only two years, it has been in deficit ever since.

In 1971, the U.S. was forced to suspend convertibility of the dollar. In 1973, the world's financial experts finally established a system of floating exchange rates. And the dollar has been buffeted since.

Despite the dollar's depreciation, and despite some half-hearted attempts at export promotion, the U.S. trade position has steadily declined throughout the 1970's. The U.S. started the seventies with a \$2.7 billion trade surplus. It probably will end this year with a \$20 billion deficit. And even that will be an improvement over last year's \$28.4 billion.

Obviously, oil has helped lubricate the slide. This year, imports of all petroleum products will account for 26% of total U.S. imports. On a dollar basis, oil's share of total imports has exceeded 23% since 1974.

It's also true that, since the early seventies, the U.S. trade balance would have shown a consistent surplus had it not been for oil. But the fact remains that that surplus would have been declining since 1975.

Until this year. As a result of aggressive export marketing, total U.S. exports in 1979 will be about \$180 billion. That's a 25% improvement over 1978. But it will take even more aggressive export marketing, coupled with realistic trade policies, for the U.S. to improve its trade position against the competition ahead. □



Western Europe's vintage year may not repeat

For the West European chemical industry, 1979 will go down as something of a "vintage year." Demand was strong. Companies' sales advanced. Prices firmed. Profits were up.

This doesn't mean that industry leaders believe they have turned the corner. In the coming decade, they face a number of strategic imponderables. Not least among these are the severity of the recession now widely predicted and its effect on business, as well as the availability and price of oil and oil derivatives.

The latest annual economic report of the Commission of the European Communities opens on a somber note. "Expectations for 1980 have to be relatively modest," it states, "taking into account the rise in the price of oil in the past 12 months, and the current recession in the North American economy." There are, too, "many unresolved domestic economic problems" in the EC member states—Belgium, Denmark, France, West Germany, Ireland, Italy, Luxembourg, the Netherlands, and the U.K.

Among the key macroeconomic indicators, gross domestic product (GDP) underwent a 3.1% volume growth this year for the European Economic Community as a whole, matching that of 1978. Next year, however, only a 2% gain is foreseen. This will mean that EEC will fall short of its 1976-80 growth objective.

There are, of course, variations in the relative strengths of the economies among the individual EEC members. West Germany (GDP up 4.3%) and Ireland (up 6%) turned in

Western Europe

Business was strong in 1979 but rising costs and competition from imports are two big worries for 1980

Dermot A. O'Sullivan, C&EN London

the best performances this year. On the other end of the scale, the U.K. was the weakest, with a GDP gain of a mere 0.3%. Next year, the U.K.'s GDP is expected to decline 1%.

The unemployment rate has been edging up throughout EEC. This year, it stands at 5.6% of the labor force compared to 4.3% five years ago. Next year, the level of unemployment is expected to move even higher, to 6.2%.

Inflation, too, is a source of continuing worry. The increase for the year is pegged at about 9% for EEC as a whole. Belgium, West Germany, Luxembourg, and the Netherlands have managed to hold the rise in consumer prices below 5%. But double-digit inflation rages in Denmark, France, Ireland, Italy, and the U.K.

Nevertheless, this Christmas will be a reasonably happy one for exec-

Most European chemical firms report sharp profits gains

\$ Millions	Sales	Change from 1978	Earnings before taxes	Change from 1978
Akzo	\$4,606.6	13%	\$245.6	80%
Albright & Wilson	389.6	0	21.5	-48
BASF	11,011.5	21	772.4	77
Bayer	11,306.3	14	673.0	44
Fisons	452.2	25	16.0	-36
Hoechst	11,376.4	10	712.6	49
Imperial Chemical Industries	8,525.7	17	908.9	24
Rhône-Poulenc	3,581.7	16	70.3 ^a	100
Solvay	2,031.5	26	65.2 ^a	57
Unilever	11,679.3	12	704.7	9

^a Net profit after taxes. Note: Data are for nine months ended Sept. 30, 1979, for Akzo, BASF, Bayer, Hoechst, and Imperial Chemical Industries, and for six months ended June 30, 1979, for Albright & Wilson, Fisons, Rhône-Poulenc, Solvay, and Unilever.

utives of most West European chemical companies. Business has turned out to be considerably better than they had anticipated a year ago. Even hard-pressed Akzo, of the Netherlands, after several years of operating in the red, has moved firmly back into profitability and has resumed paying a modest dividend.

For DSM, also headquartered in the Netherlands, an unexpected business pickup in the second half of the year ensures that it will round out 1979 with a small profit gain. Earlier, a loss had been forecast. DSM had registered a net loss of \$18.5 million during the first half of the year.

France's Rhône-Poulenc ranks as one of this year's star performers among the West European chemical giants. Figures for the first half of the year show a net profit of \$70.3 million, double that of the January-through-June period of 1978. Company president Jean Gandois indicates that net profit for the year might be as high as \$170 million, three times last year's earnings. The improvement reflects both the overall strength of business as well as the effects of the sharp streamlining of the organization that has been under way since 1975, when the company was heavily in the red.

West Germany's three largest chemical concerns—BASF, Bayer, and Hoechst—also have good reason to be pleased with this year's turn of events. Comments of Matthias Seefelder, BASF's chairman, sum up the experience of the three companies. "The most surprising thing this year," he says, "is that the seasonal lull usual in the summer was essentially non-existent. The fear of the holiday slump period proved unjustifiable."

North Sea oil contributed to Imperial Chemical Industries' 17% advance in sales and 24% gain in pretax profits for this year's first nine months. ICI has a 19.2% stake in the Ninian field that began producing commercially this year.

The overall improvement in the financial picture of the West European chemical companies reflects both a strengthening in volume of products sold and an improvement in pricing. For BASF, roughly two thirds of the increase in sales can be attributed to greater volume, and one third to higher prices.

The fact that the high level of demand for a wide spectrum of chemical products continued unabated throughout the year took most people by surprise. It had been assumed that the upturn of orders that began in the fourth quarter of 1978 reflected a buildup of inventories as a hedge against anticipated price increases, a buildup that would tail off around midyear. Although undoubtedly there has been some restocking, the consensus is that this hasn't occurred at anywhere near the degree that it did in 1974.

Because demand was buoyant and continuous throughout the year, companies achieved better utilization of plant capacities. This, in turn, shaved operating costs.

Welcome as the higher throughput

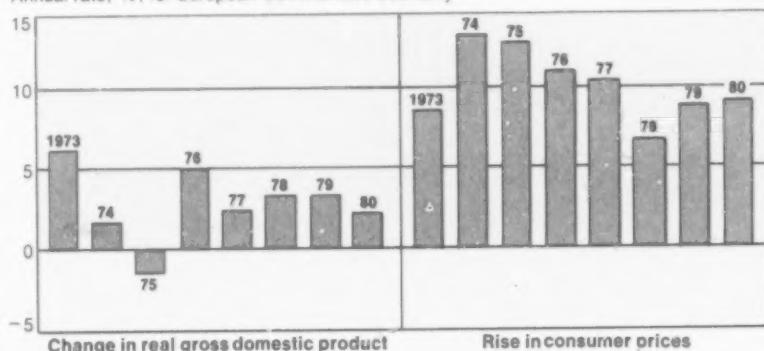
of plants has been, there still is considerable room for improvement. West European petrochemical units generally have been underutilized in recent years. And it's expected that this state of affairs will persist for the coming five years at least.

In 1978, for example, the latest year for which firm data are available, overcapacity resulted in petrochemical plants operating at less than 80% of nameplate capacity. Operating rates generally were between 70 and 75%. Plants making acrylonitrile-butadiene-styrene and polystyrene generally have fared worse.

This condition is not likely to change much next year. Indeed, output of caprolactam and ethylene, as a percentage of installed capacity, is expected to slip below 70%. By 1985,

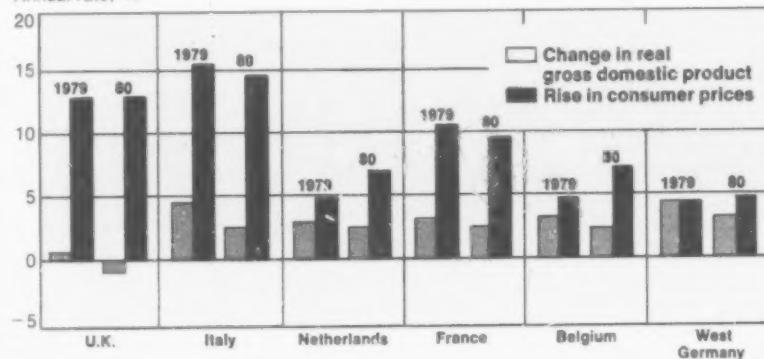
Slower growth, more inflation forecast for Europe ...

Annual rate, % for European Communities economy



... with the outlook especially dim for the U.K.

Annual rate, %



Source: Commission of the European Communities

however, the situation is expected to improve, with ethylene plants running at about 78% of capacity and only a few products being produced at rates less than 75% of capacity.

The rise in feedstock and energy prices and labor costs throughout the year added to operating expenses. In Western Europe, the contract price of naphtha, which was just under \$160 per metric ton last January, has risen to between \$295 and \$310 per metric ton. The spot price of naphtha, meanwhile, has doubled from about \$193 per metric ton last January to \$385 per metric ton now. There is every reason to expect that the rise will continue.

Their greater outlays for raw materials and energy have helped chemical companies push through price increases this year. In fact, the higher price tags attained more than compensate for the higher production costs to date.

A major concern for the 1980's is the apparent inevitability of further rises in the cost of raw materials. Against the background of meager economic growth expected in the near term, it's questionable whether there will be much room for boosting prices to consumers. The prices of oil and gas derivatives are bound to keep

on going up, nevertheless. Moreover, availability of hydrocarbons could be seriously threatened if the current political unrest in the Middle East persists and widens.

Knowledge that oil and gas exist under the North Sea provides some modicum of consolation. Prices of oil and gas produced there, of course, will move in step with the price of oil and gas from other sources. Nor are the quantities being produced sufficient to meet Western Europe's entire demand, but it's reassuring, at least, to know of their existence.

Exploitation of North Sea hydrocarbons ranks as one of the most outstanding technical achievements of this past decade in Europe. The first significant discovery of offshore oil was made just 10 years ago in the Norwegian sector by a consortium led by Phillips Petroleum.

Intensive well development and pipe-laying activities ensued. The Norwegian Ekofisk field began yielding oil in 1971. In 1975, the first flow of oil by pipeline from the U.K.'s Forties field began. All told, there now are some 14 North Sea oil fields in production or under development.

Established petrochemical operations, such as those of BP Chemicals and ICI, are using North Sea oil and gas. But only two have emerged that are designed solely around this source of hydrocarbons. One is at Rafnes, in

southern Norway. There, Norettyl—owned 51% by Norsk Hydro, 33% by the Norwegian-state-owned Statoil, and 16% by Saga Petrokjemie—has a cracker using natural gas liquids recovered from Ekofisk by Phillips at Teesside, England. (A deep seabed trench between the Ekofisk field and Norway prevents laying a connecting pipeline directly to the Norwegian mainland.)

The other complex based on North Sea hydrocarbons still is on the drawing boards. It will center on an ethane cracker which Esso Chemical, Exxon's U.K. subsidiary, recently received U.K. government approval to build at Mossmorran, near Edinburgh, Scotland. When completed in 1984, the \$700 million unit will be able to produce 1.1 billion lb of ethylene annually.

The Mossmorran cracker will be the first of its kind in Western Europe to operate on ethane. (To hedge its feedstock supply bets, Esso Chemical is building flexibility into the cracker to allow use of some propane). Ethane will be separated from a mixture of gases piped from the Brent oil and gas field (about 280 miles out in the North Sea) jointly owned by Exxon and Royal Dutch/Shell.

Shell Chemical will finance half the cost of the cracker and will have access to half the plant output for its existing operations at Carrington and Stanlow, England. Esso Chemical initially will ship its ethylene to its sister companies in continental Europe. But it's reasonable to expect that the availability of ethylene at Mossmorran will attract plants to the site to make use of it there.

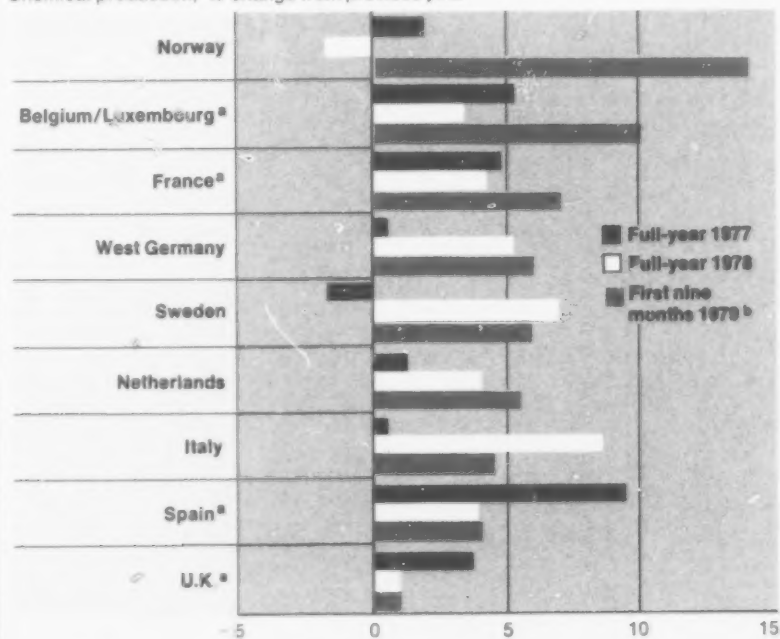
An overriding concern among European chemical executives right now is the growing competitive edge that U.S. materials hold over those of European origin, not only in Europe itself but elsewhere. The threat of competition began to take force during the past few years as the value of the U.S. dollar weakened against major European currencies.

The slide in the U.S. dollar has been more pronounced against some currencies than against others. In the case of the West German deutsche mark, for example, the dollar was valued at 2.62 DM on Dec. 31, 1975. Today, it is about 1.75, only two thirds as much. Over the same time span, the Belgian franc and the Dutch guilder strengthened about 28%. The French franc changed less, gaining less than 10% against the dollar during the past five years. The cyclical movement of the more volatile British pound has meant that its overall shift against the dollar hasn't been so pronounced.

The effect of a weak dollar is that

Production is growing faster in much of Western Europe this year

Chemical production, % change from previous year



^a Excludes synthetic fibers. ^b Estimated. Source: Chemical Industry National Federations

U.S. goods become cheaper to buy in Europe. Europeans also point to the added advantage of lower per-unit manufacturing costs that their U.S. counterparts enjoy, stemming from larger, more integrated plants and less costly labor.

More recently, however, another factor has entered the equation. As hydrocarbon prices in Europe have increased, the differential between the controlled prices of U.S. oil and gas has widened. And there is every indication that the gap will become greater. Despite President Carter's move to deregulate U.S. domestic oil and gas prices, Europeans argue that it will take several years for the measures to take effect, and some are frankly skeptical that anything concrete will happen.

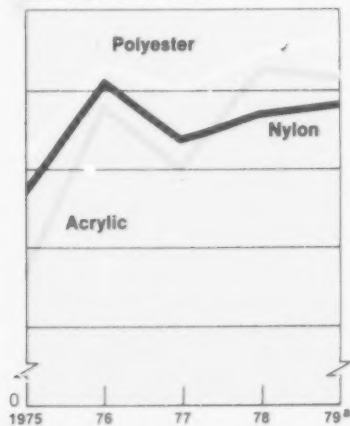
Exacerbating the situation is the current economic slowdown in the U.S. As U.S. demand for a variety of products weakens, so the reasoning goes, the tendency will be for U.S. producers to seek outlets abroad.

This already seems to be happening in the case of man-made fibers. Europeans are smarting at the arrival of increasing volumes not only of fibers as such but of textiles and finished goods.

According to figures compiled by Paris-based Comité International de la Rayonne et des Fibres Synthétiques (CIRFS), 30 million lb of polyester filament and yarn came into Europe from the U.S. during the first six months of this year. That exceeds the 27.7 million lb imported during all of 1978, which, in turn, was 41% more than in 1977. Imports of texturized polyester filament yarn, too, are going up—13.5 million lb in the first half of this year against 10.3 million lb in all of 1978 and 7.5 million lb in 1977.

Little growth for fibers

Production, billions of lb



* Estimated. Source: CIRFS (International Rayon & Synthetic Fibers Committee)

Western Europe hopes to boost operating rates in 1980's

Billions of lb per year	1978		1980		1985	
	Nameplate capacity	Utilization rate	Nameplate capacity	Utilization rate	Nameplate capacity	Utilization rate
Ethylene	32.3	74%	37.9	69%	40.1	78%
Propylene	18.2	74	20.9	71	22.2	85
Butadiene	4.4	77	4.7	78	5.1	87
Styrene	7.6	75	8.1	74	8.6	84
Benzene	13.7	67	14.9	67	15.8	72
Acrylonitrile	2.8	75	3.1	72	3.1	82
Phenol	3.1	72	3.3	75	3.8	78
Caprolactam	1.9	75	2.1	68	2.1	76
Acetic acid	2.5	75	2.6	79	3.1	81
Vinyl acetate	1.3	73	1.4	84	1.6	90
Vinyl chloride	13.0	71	13.7	72	16.0	69
Polyvinyl chloride	11.5	73	12.4	73	14.0	73
Polyethylene, low-density	12.0	77	13.8	71	15.1	80
Polyethylene, high-density	4.8	74	5.4	72	6.3	75
Polypropylene	4.3	71	5.0	72	6.1	90
Polystyrene	6.0	67	6.4	69	6.5	76
Acrylonitrile-butadiene-styrene	1.2	62	1.3	60	1.6	69

Note: Nameplate capacity is greater than effective capacity. Source: Company data

Figures for acrylic staple provide another stark illustration. Here, too, the nearly 23 million lb of U.S. product imported into Western Europe from January through June of this year was more than last year's 22 million lb total, which itself was 41% ahead of the 1977 total.

Some countries are harder hit by U.S. imports than others. The U.K. has come up with some startling statistics. There, imports of U.S.-made polyester texturized yarn this year are likely to exceed 14 million lb, 240% more than in 1978. For 1978, the quantity swelled 1000% from 1977 to 4 million lb. Polyester staple imports from the U.S. this year will advance almost 560% (to more than 5.6 million lb) above the 1978 total.

Recent experience with vinyl acetate substantiates the concern. This year, upward to 190 million lb of the chemical will arrive in Western Europe from the U.S., about 40% more than in 1978, at a price considerably less than European-made product as a result of the lower cost of U.S. ethylene.

This is happening at a time when the man-made fibers business in Western Europe is far from buoyant. All the major producers have been cutting back their operations in the face of declining demand. Plant closures and deeper cuts in the labor force are likely to continue.

The European Council of Chemical Manufacturers' Federations (CECIC) in Brussels is watching what is taking place in the man-made fibers business with growing alarm. The concern is that the trend might spill over into petrochemicals generally.

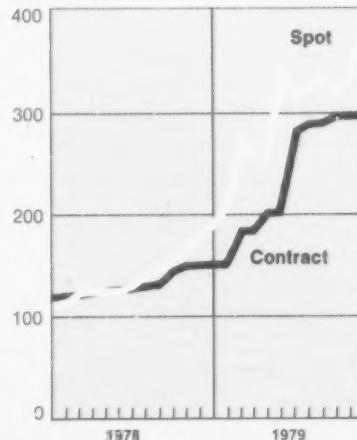
"The European chemical industry

sees itself confronted by the threat of U.S. products being imported into Western Europe at prices with which [we] cannot compete," observed Jacques Solvay, CEFIC's incoming president, at the organization's annual assembly in Vienna last month.

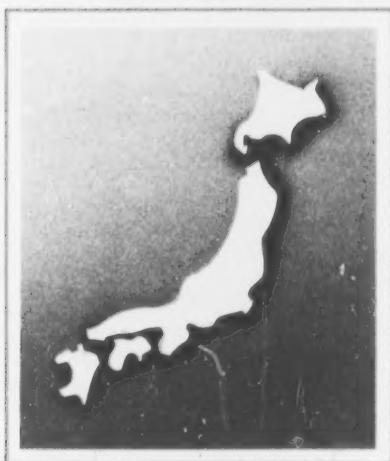
Representatives of CEFIC and CIRFS have been keeping the EC Commission apprised of the situation. Etienne Davignon, the EC commissioner for industry, has been holding discussions with the U.S. at both government and industry levels. One avenue open to the Europeans if attempts to achieve voluntary restraint from the U.S. fail would be to initiate more formal action within the framework of the General Agreement on Tariffs & Trade. □

Naphtha prices are soaring

\$ per metric ton



Source: European Chemical News



Rising raw material costs plague Japanese

Japanese chemical companies seem to be continuously climbing mountains—only to find another mountain on the other side. As they head into the last quarter of another fiscal year and the start of a new decade, Japan's petrochemical community is staring at a formidable obstacle.

The Japanese petrochemical industry was booming when the first oil crisis hit it in October 1973. In late 1974 and throughout most of 1975, it climbed its first mountain. With crude oil prices five times what they were and naphtha prices soaring, petrochemical output declined. Overall, production slipped 2% in value and even more in volume. Profits dropped or disappeared.

Last year, Japan's petrochemical industry faced a different obstacle, but a big one nonetheless. This time the mountain was price.

In 1978, petrochemical production increased. Ethylene output, for instance, was up 10%. Ethylene oxide production jumped 17%. Output of the major resins was significantly higher. But higher volumes of petrochemicals had to be sold at much

Japan

Petrochemical producers had a good year in 1979 but still must meet the challenge of costly imported feedstocks

Earl V. Anderson, C&EN New York

lower prices. Resin prices declined 8% to 14%, depending upon type and grade. Among basic petrochemicals, the price of ethylene dropped 12%, propylene 22%, and benzene 21%. On average, the price of basic petrochemicals slipped 16%. Profits again were affected.

This year is different. For most of 1979, Japanese petrochemical producers have enjoyed a breather. Through the first eight months of 1979, production of most petrochemicals was way ahead of last year. Ethylene and propylene set the pace, with increases of 10 and 9%, respectively. Production gains for the major aromatics—benzene, toluene, and xylene—ranged from 7 to 9%.

Plastics output fared even better. Polyethylene production was 17% ahead of last year through the first eight months of 1979. Polystyrene was up 22%, polyvinyl chloride 36%, and polypropylene a whopping 41.5%.

In contrast to 1978, however, petrochemical prices also have increased substantially this year. In October, for instance, prices of a 40-chemical sampling rose 1.1%. According to the Ministry of International Trade & Industry (MITI), this put the average price of these chemicals 14.5% higher than it was in October 1978. The average wholesale price of petrochemicals increased in each of the first 10 months of 1979. Not one of the 40 chemicals sported a lower price in October than it did in January.

Meanwhile, Japan's major producers want to increase ethylene's price from 145 yen per kg to 160 yen (about 31 cents per lb at present exchange rates). If they are able to convince producers of ethylene derivatives to accept it, the price of

Both sales and profits are expected to be up in chemical process industries

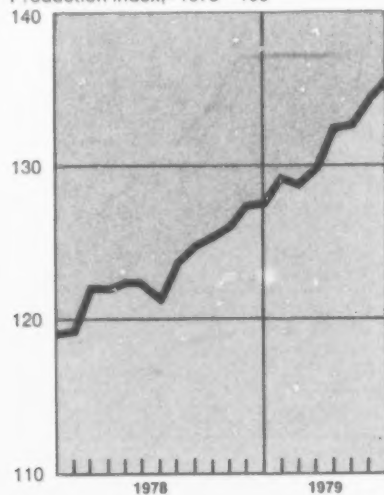
% change from previous year	Sales		Operating profits	
	Fiscal 1980	Fiscal 1979	Fiscal 1980	Fiscal 1979
Chemicals	18.9%	3.2%	103.6%	206.9%
Pharmaceuticals	9.7	11.7	7.0	31.6
Paint and ink	13.7	5.6	16.5	57.2
Petroleum	23.0	-10.2	-242.8	-77.4
Rubber	12.0	5.1	18.3	20.9
Pulp and paper	15.7	-1.0	128.1	-1.0
All manufacturing	11.4	3.0	40.8	45.1

Note: Fiscal year ends March 31 Source: Nomura Research Institute

Production moves higher in Japan, with plastics buoying chemical output

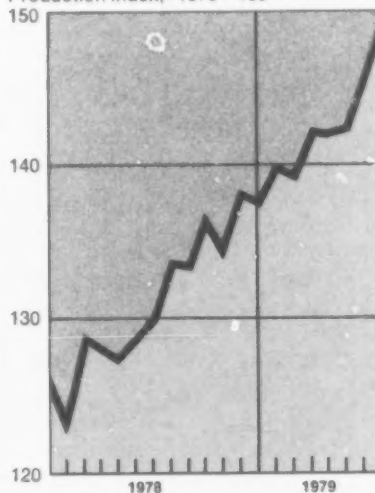
All manufacturing

Production index, ^a 1975 = 100



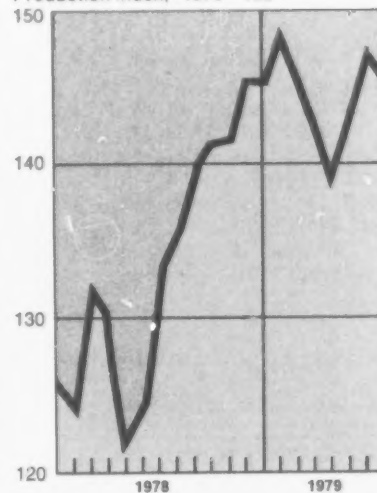
All chemicals

Production index, ^a 1975 = 100



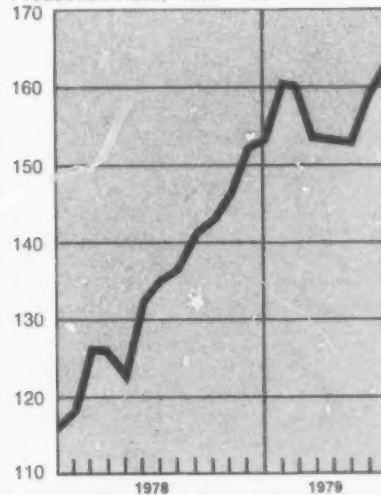
Petrochemicals

Production index, ^a 1975 = 100



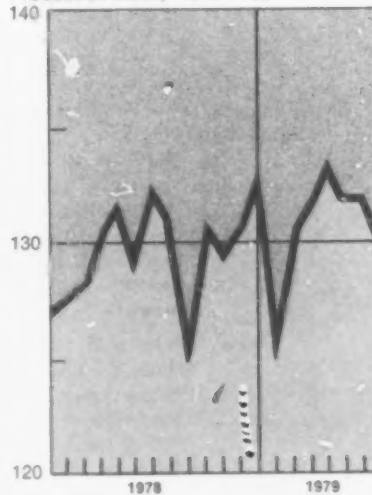
Plastics

Production index, ^a 1975 = 100



Synthetic fibers

Production index, ^a 1975 = 100



Synthetic rubber

Production index, ^a 1975 = 100



^a Seasonally adjusted. Source: Ministry of International Trade & Industry

ethylene will increase for the sixth time since April and will have doubled in less than a year.

This year's combination of higher production and higher prices has had an equally pleasant effect on profits. According to a recent survey of 36 chemical companies, sales during the first half of fiscal 1979 (March through September) were up 13%, compared to the previous six-month period, but operating profits for the half-year were 43% higher than during the previous six months.

Now, however, another mountain has become visible and will be even more so in the first quarter of 1980. Overall petrochemical production may or may not decline, but it certainly won't grow so rapidly as it has this year. Sales growth also probably will taper off. According to the 36-company survey, sales in the six months ending next March are estimated to grow only 4.5%.

Barring another tremendous hike in naphtha prices, additional price increases in basic petrochemicals will be hard to push through. As a result, profits may be lower as the Japanese petrochemical industry heads into the new decade. Between March and September 1979, operating profits of

the 36 companies surveyed rose 43%. But in the six months ending with March 1980, these companies expect profits to decline 5%.

Answers to a survey by the Japan Chemical Industry Association also reveal the changing attitude among chemical executives in Japan. They described business for most of 1979 in such terms as "very good" and "bright." But, starting in late 1979 and continuing at least through the first half of 1980, their collective attitude toward business prospects adds up to "rather depressing."

The basic reason most Japanese chemical executives feel uneasy about future business is the soaring prices of raw materials, particularly naphtha, and the difficulty in securing adequate supplies. Naphtha, in fact, has been the Japanese chemical industry's primary problem for several years.

Naphtha supplied to Japan under long-term contract now costs 55,000 yen per kiloliter. That's a hefty 90 cents per gal or about \$35 to \$36 per bbl, about 2.5 times higher than it cost at the beginning of 1979.

So concerned are Japanese chemical companies about naphtha that they have agreed with several European chemical companies to monitor prices. Possibly starting next month, participating Japanese and European companies will register their naphtha

purchase prices with Klynveld Kraegenhof, a Brussels-based auditing company. Average prices and volumes will be released through the European Petrochemical Association.

With domestic supplies tight, Japanese chemical companies have been relying heavily on expensive imported naphtha. Over the past few months, however, they have been cutting back on imported material.

In October, for instance, naphtha imports were down 2.4% from September. More important, they were almost 19% lower than had been expected. An additional drop, perhaps as much as 6%, was expected in November. And there's little reason to believe that imports will go anywhere but down again this month.

There are several reasons for petrochemical producers' exercising restraint on naphtha imports. The principal one, of course, is cost. High prices on imported naphtha have boosted production costs. Another reason is that basic petrochemical producers are starting to switch to alternate feedstocks, such as liquefied petroleum gas and butane.

The mountain now lying ahead of Japan's chemical industry may not be so high as those it has climbed in the past. But it is trying to do everything it can to make the climb as painless as possible. □

Plastics pace growth in Japanese chemical production this year

Thousands of metric tons unless otherwise noted	1978	Eight months 1978	Eight months 1979	% change	Thousands of metric tons unless otherwise noted	1978	Eight months 1978	Eight months 1979	% change
INORGANIC CHEMICALS									
Ammonium chloride	718	473	488	3.2%	Diethylphthalate	265	177	165	-6.8%
Ammonium sulfate	1929	1317	1259	-4.4	Ethylene	4387	2834	3125	10.3
Calcium carbide	555	364	370	1.7	Ethylene dichloride	1837	1212	1345	11.0
Calcium superphosphate	551	364	378	3.9	Ethylene glycol	630	401	354	-11.7
Carbon black	489	320	352	10.0	Ethylene oxide	631	406	380	-6.4
Chlorine, liquid	651	446	473	6.0	Methanol	907	604	659	9.1
Hydrochloric acid	540	364	325	-10.7	Octanol, synthetic	254	164	164	0
Nitrogen ^a	3717	2476	2642	6.7	Phenol, synthetic	249	163	173	6.1
Oxygen ^a	6329	4162	4712	13.2	Phthalic anhydride	288	194	194	0
Sodium carbonate	1162	749	880	17.5	Propylene	2963	1915	2080	8.6
Sodium hydroxide	2777	1881	1918	2.0	Propylene glycol	163	108	110	1.9
Sodium silicate	654	432	469	8.6	Styrene	1122	746	813	9.0
Sulfuric acid	5437	4248	4332	2.0	Terephthalic acid	590	368	424	15.2
Titanium dioxide	171	113	125	10.6	Toluene	861	573	620	8.2
ORGANIC CHEMICALS					Toluene diisocyanate	81	41	41	0
Acetaldehyde	587	384	404	5.2	Xylene	1248	827	899	8.7
Acetic acid	518	340	347	2.1	Urea	2090	1366	1403	2.7
Acetone	261	172	177	2.9	PLASTICS				
Acrylonitrile	609	406	393	-3.2	Phenolic resins	268	175	200	14.3
Benzene	2015	1331	1420	6.7	Polyethylene	1767	1201	1402	16.7
Butadiene	658	429	442	3.0	Polypropylene	745	460	651	41.5
Butanol	222	139	165	18.7	Polystyrene	1032	654	798	22.0
Caprolactam	427	293	297	-2.1	Polyvinyl chloride	1204	736	1002	36.1
Cyclohexane	477	324	329	1.5	SYNTHETIC RUBBER				
						1028	679	731	7.7

^a Millions of cubic meters. Source: Ministry of Trade & Industry

Latin America



Mexico and Brazil have ambitious chemical plans

The Latin American petrochemical spotlight continues to shine brightest on Mexico and Brazil.

In Argentina and Venezuela, faltering chemical industries are trying to get back on the track. Argentina's petrochemical growth has been stunted by the country's sick economic conditions and by on-again-off-again investment policies.

Now, however, the Argentine petrochemical industry finally may get rolling again. The country's new petrochemical promotion law permits private companies to participate in

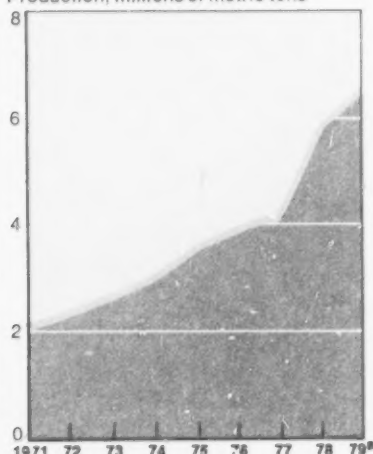
The two leading Latin American petrochemical producers are rushing headlong into the chemical big time

Now Venezuela has a new policy designed to improve its economy. Most price controls have been lifted, which should allow chemical companies to earn a reasonable profit. Import restrictions have been lifted, too, although tariffs for most products are about 100%. Nevertheless, this likely will stimulate competition.

The one real indicator that the Venezuelan petrochemical industry is rolling will come when the troubled El Tablazo complex is operating at full capacity again. Presumably, this

Uptrend continues for Mexican petrochemicals

Production, millions of metric tons



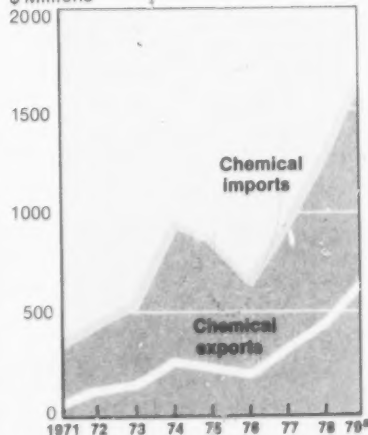
■ C&EN estimate. Source: Petroleos Mexicanos

basic petrochemical output. New tax laws and preferred access to oil and gas feedstocks also are likely to stimulate petrochemical activity.

Venezuela's oil-based economy is sputtering under a heavy dose of discipline and austerity. "A mortgaged country" is how one economist describes Venezuela. Many businessmen who supported President Herrera's attempt to cool the country's overheated economy now wonder if he may have turned the thermostat down too far. Many huge development projects started by the previous government remain only partially complete. Inflation has driven up the cost of most of these projects.

Mexico's chemical trade deficit widens

\$ Millions



■ C&EN estimate. Source: Asociación Nacional de la Industria Química

will be by the end of the year. But El Tablazo has missed deadlines before.

Brazil and Mexico, too, have problems. But these problems haven't slowed down their headlong rush into the petrochemical big time.

The two leading Latin American petrochemical producers are building up their industries under entirely different circumstances. Mexico is oil rich; Brazil is oil poor and depends heavily on imports.

Mexico is riding the crest of an oil and gas bonanza. In the past three years, Petroleos Mexicanos (Pemex), the state-owned oil company, has discovered three major oil fields—in Bermudez, Cantarell, and Cicontepco, Pemex drilled 188 test wells, hit oil or gas in 182 of them, and now is producing from 152.

Mexico's proven reserve of oil has grown to 45.8 billion bbl, with another 45 billion bbl listed as probable and 200 billion bbl as potential. The last may be conservative. Proven natural gas reserves are conservatively listed at about 60 trillion cu ft.

Recently, Pemex has been producing about 1.6 million bbl per day of oil and is expected to hit 2.25 million bbl next year. If it does, Pemex will be two years ahead of schedule.

It is upon this base that Mexico

hopes to build its petrochemical industry. In Mexico, primary petrochemicals are the exclusive domain of Pemex. No private participation is permitted. Primary petrochemicals are defined as the basic building blocks, such as ethylene-propylene, the aromatic hydrocarbons, and their first-order derivatives. Thus, resins such as polyethylene and polypropylene fall to Pemex.

Pemex' basic petrochemical capacity now is about 8 million metric tons per year. But, with two major petrochemical complexes in the works, that capacity should increase to a tidy 18 million by the mid-1980's.

The first new complex already is being built at La Cangrejera, in Vera Cruz. At the core of the complex will be a 500,000 metric-ton-per-year ethylene unit. But La Cangrejera also will include capacity to produce propylene (240,000 metric tons), benzene (299,000), styrene (150,000), acetaldehyde (100,000), ethylene oxide (100,000), and low-density polyethylene (240,000). And there will be much more.

Construction at La Cangrejera is behind schedule, however. Probably the only units operating next year will be acetaldehyde and ethylene oxide plants, with perhaps an oxygen plant in addition.

The remaining units will have to wait until 1981. Meanwhile, Pemex plans to supply La Cangrejera with

ethylene from its Parajitos plant until the La Cangrejera ethylene plant is operating.

By the time La Cangrejera is complete, Pemex will be looking ahead to another petrochemical complex at Morelos. Morelos also will feature a 500,000 metric-ton-per-year ethylene plant. It will include a battery of downstream units, including plants to produce 100,000 metric tons per year of high-density polyethylene and 100,000 metric tons of polypropylene.

Target date for completing the Morelos complex is 1982. But with the delays at La Cangrejera, Morelos may not be ready until 1983—perhaps later. Because of the lessons learned at La Cangrejera, Pemex expects construction at Morelos to go more smoothly.

Until most of the units at La Cangrejera come on stream in 1981, Pemex will have to get as much production as possible from its existing 8 million metric tons of primary petrochemical capacity. Last year, that output was almost 5.8 million metric tons, 37% higher than in 1977.

This year, Pemex' output of primary petrochemicals likely will increase about 11% to 6.5 million metric tons. Most of the increase will come from ammonia. No other major new capacity for primary petrochemicals has been operating. Pemex had hoped to produce almost 7.4 million metric tons of primary petrochemicals in

Production of chemicals is generally strong in Brazil this year

Thousands of metric tons	First-half	Full year			Thousands of metric tons	First-half	Full year		
	1979	1978	1977	1976		1979	1978	1977	1976
ORGANIC CHEMICALS									
Acetic acid	26	47	39	29	Ammonium sulfate	26	59	40	39
Acetic anhydride	12	25	26	—	Carbon black	64	125	122	111
Acetone	22	44	44	39	Chlorine	177	503	313	226
Benzene	112	172	145	121	Hydrochloric acid	122	237	160	92
Butadiene	57	81	81	81	Nitric acid	126	353	341	374
Cumene	49	98	98	92	Phosphoric acid	83	170	181	183
Dimethyl terephthalate	24	35	9	—	Sodium hydroxide	315	572	317	259
Ethylene	269	399	362	349	Sodium sulfate	34	64	62	79
Ethylene oxide	41	40	31	28	Sulfuric acid	798	1578	1556	1439
Formaldehyde (37%)	64	118	115	125	Titanium dioxide	17	32	28	24
Methanol	54	65	80	—	Urea	56	113	78	84
Phenol	36	70	71	64	PLASTICS				
Propylene	223	238	232	180	Polyethylene, high density	52	53	54	42
Propylene oxide	43	71	25	—	Polyethylene, low density	128	219	200	187
Styrene	85	145	64	62	Polypropylene	41	25	—	—
Toluene	38	72	68	53	Polystyrene	53	96	85	88
Vinyl chloride	47	106	108	94	Polyvinyl chloride	87	173	160	152
Xylenes	77	93	70	50	SYNTHETIC ELASTOMERS				
INORGANIC CHEMICALS					Polybutadiene	15	33	33	23
Ammonia	145	259	184	176	Styrene-butadiene	77	158	146	130
Ammonium nitrate	80	228	215	161					

Source: Abiquim (Associação Brasileira da Indústria Química e de Produtos Derivados)

Production was higher in Mexico last year for most chemicals

Thousands of metric tons	1978	1977	1976	1975	Thousands of metric tons	1978	1977	1976	1975
ORGANIC CHEMICALS									
Acetaldehyde	45	44	47	32	Vinyl chloride	56	56	60	45
Acetic acid	57	36	25	39	Xylenes	76	62	66	52
Benzene	79	75	99	90	INORGANIC CHEMICALS				
Dimethyl terephthalate	128	143	129	38	Ammonia	1579	944	865	801
Ethylene	258	230	228	213	Chlorine	175	172	143	127
Ethylene dichloride	97	98	104	90	Hydrochloric acid	97	80	72	69
Ethylene glycol	56	49	42	45	Nitric acid	173	182	183	186
Formaldehyde (37%)	48	42	40	33	Phosphoric acid	346	392	363	392
Methanol	103	33	32	32	Sodium carbonate	436	413	390	407
Propylene	138	138	114	93	Sodium hydroxide	247	263	228	209
Styrene	38	36	35	27	Sulfuric acid	2372	2296	2178	2047
Terephthalic acid	55	49	28	5	Urea	156	179	161	155
Toluene	124	116	132	116					

Source: Asociación Nacional de la Industria Química

1979. Operating problems, however, which a Pemex spokesman describes as "no big thing," probably will hold total production to only about 88% of the target.

Ammonia figures heavily in Mexico's petrochemical plans, both to supply the more than half the population working in agriculture and for export. Until 1977, Mexico had only 936,000 metric tons per year of ammonia capacity. That year, Pemex brought a 445,000 metric-ton-per-year unit on stream at Cosoleacaque. Last year, it added another 445,000-metric-ton plant there and started up a 300,000-metric-ton unit at Salamanca. Mexico has plans to build four more 445,000-metric-ton units.

Next year, Pemex hopes to increase its output of basic petrochemicals about 10%. With only two units—acetaldehyde and ethylene oxide—scheduled to come on stream at La Cangrejera, most of the increase will be again from ammonia.

Mexico's petrochemical buildup has other countries wondering if it will become a major factor in chemical exporting. It already exports huge amounts of ammonia. But significant chemical exports must wait until it sheds its still heavy dependence on imports. Last year, Mexico's chemical balance of trade deficit was \$881 million. This year, despite increased ammonia exports, that deficit is likely to exceed \$1 billion.

Like Mexico's, Brazil's first priority is to substitute domestic production for imports. Exports can come later. Not that Brazil doesn't export chemicals now. This year, for instance, its chemical exports will be about 38% higher than in 1978. But those exports will amount to a minuscule \$275 million, with about 44% of them organic intermediates.

Chemical imports, meanwhile, will outdistance exports a factor of 10. Faced with a shortage of some plastics, particularly low- and high-density polyethylene, and a shortage of most aromatics, Brazil's chemical import bill this year will jump 40% to \$2.6 billion.

This will give Brazil a \$2.3 billion chemical trade deficit that it can ill afford. Brazil's overall trade deficit is soaring and probably will come close to \$2.5 billion by year's end. Chief culprit is Brazil's dependence on imported oil. Through October, the country's imports totaled \$14.4 billion. Oil accounted for \$5.8 billion of that.

Brazil's trickle of chemical exports this year may surprise some international chemical traders. Last fall, virtually all of Brazil's second massive petrochemical complex (or "pole," as they are called in Brazil) came on stream. The \$3.1 billion behemoth at Camacari, in the northern state of Bahia, may be the world's largest fully integrated petrochemical operation.

Only acrylonitrile and detergents plants are yet to come on stream. The acrylonitrile unit should be just about ready to begin operation. The detergents unit won't start until mid-1981.

Counting these two units, Camacari will be able to produce a staggering 3.6 billion tons per year of petrochemical products. The core unit is a 388,000 metric-ton-per-year ethylene plant that also can produce 200,000 metric tons per year of propylene and 130,000 metric tons of benzene. Downstream units include styrene (100,000), polystyrene (45,000), ethylene oxide (105,000), ethylene glycols (142,000), low-density polyethylene (100,000), and high-density polyethylene (60,000). There also is a 150,000 metric-ton

vinyl chloride unit and a 140,000 metric-ton polyvinyl chloride plant.

The Camacari plants are helping to boost Brazil's petrochemical output this year. At the half-year mark, for instance, ethylene production was running at a rate of 540,000 metric tons per year, 35% ahead of 1978's pace. As much high-density polyethylene was produced during the first six months of 1979 as in all of 1978.

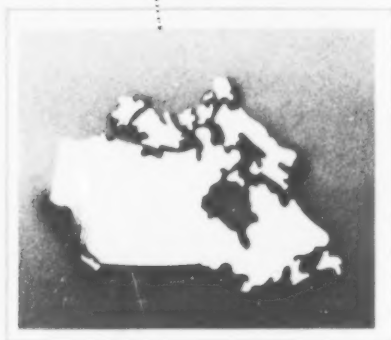
This burst in production, however, is not reflected in Brazil's chemical exports. The explanation lies in Brazil's unique domestic market for chemicals. The best word to describe Brazil's domestic market is "latent." It always seems ready and able to soak up new increments of capacity. Selling chemicals produced in Brazil seems to be no problem. "Our customers always seem to be waiting for it," says one chemical executive.

The domestic market already has caught up with Camacari's huge capacity. Low-density polyethylene is a good example. Last year, Brazil produced 218,000 metric tons and imported another 32,000 metric tons. This year, the 100,000 metric-ton unit at Camacari is operating at 120% of nameplate capacity. Yet it still hasn't shut out imports completely.

Brazil is starting to build its third major petrochemical pole, a \$2.5 billion complex near Porto Alegre in the southern state of Rio Grande do Sul. At the heart of this complex will be a 420,000 metric-ton-per-year ethylene plant. This complex isn't scheduled to come on stream until mid- or late 1982. Some skeptics think it may be even later.

But most Brazilian chemical officials agree that it's already needed. Despite Brazil's economic problems—and they are awesome—chemical marketers there see no letup in demand for their products. □

Canada



Profitability improves for Canadian chemical firms

For the Canadian chemical industry, 1979 brought a return to reasonable—although certainly not spectacular—levels of profitability. Real growth was modest, overall. But for the first time in four years, chemical makers, in many cases, could raise their prices enough to compensate for their own rising costs.

Petrochemical and plastics producers benefited from rising world oil and gas prices. The Canadians, with access to lower-cost domestic feedstocks and with new world-scale plants in operation, rather quickly became highly competitive in world petrochemical markets. Canada is now a net exporter of chemicals, and exports have contributed much to the improved earnings picture.

There are dark signs, however. Activity is leveling off or declining in many segments of the Canadian

Low-cost raw materials and large-scale plants have improved chemical companies' operations but gains may fade soon

Ward Worthy, C&EN Chicago

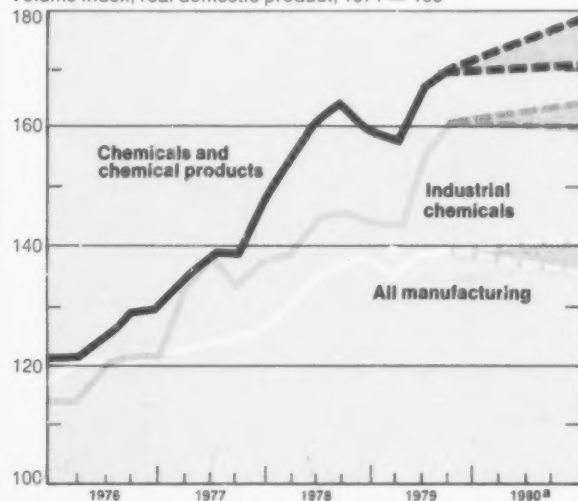
economy. Canadians naturally are concerned about the impact of the long-awaited recession in the U.S., where 70% of Canada's exports go. As 1979 ends, hardly anyone in the Canadian chemical industry is willing to predict that the good times will last.

Even though production gains were modest in 1979, chemicals still outpaced manufacturing as a whole. Over the past three years, output of chemicals has been growing about twice as fast as that in the total manufacturing segment. But the gap is narrowing. For 1979, the volume of real domestic product for the chemicals and chemical products industry will rise about 3.5% from 1978, compared to 2.5% for all manufacturing.

Chemical production actually dropped sharply in the first and second quarters of 1979 but rebounded more sharply in the third quarter. By

Chemical output will level off...

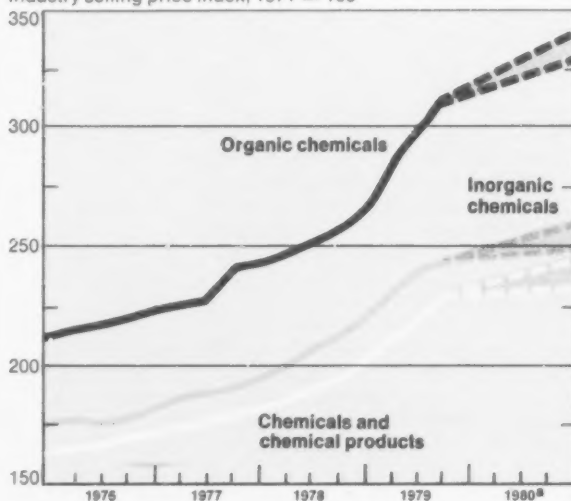
Volume index, real domestic product, 1971 = 100



^a C&EN estimates. Source: Statistics Canada

...but prices will keep rising in 1980

Industry selling price index, 1971 = 100



the end of the third quarter, however, the growth rate had leveled off again. For 1980, continuation of the long-term upward trend is about the best that can be hoped for.

Because of inflation, the dollar volume of shipments has risen at a faster rate than real production. Total shipments of chemicals and chemical products will amount to about \$9.4 billion (Canadian dollars) this year, 18% ahead of 1978's \$7.96 billion. If current trends continue, shipments will reach \$11 billion in 1980.

As might be expected, some parts of the chemical industry have done better than others in 1979. Shipments of mixed fertilizers are running about 31% ahead of last year. But in 1978, they were 30% below the 1977 level. Other strong gainers include plastics and resins, up 29%; pigments and dry colors, up 31%; and industrial organic chemicals, up 43%. Industrial inorganic chemicals are only plodding along, with shipments up 8%.

Production figures for specific chemicals tend to confirm the trends indicated by the shipments data. Production of ammonia and sulfuric acid—the two most important chemicals, in terms of tonnage—has been slightly below 1978 levels. Chlorine and caustic soda output, on the other hand, is running about 10% ahead of last year.

In contrast to the generally lackluster performance of the inorganics, organic chemicals and plastics show big gains. Benzene production, for example, is up about 30% from 1978 levels, and formaldehyde output about 20%. Although ethylene output went up only about 7%, polyethylenes increased some 40%.

At the end of September, the selling price index for chemicals and chemical products had risen 15.2% from the year-earlier level. For some product categories, price increases are

substantially above the average: mixed fertilizers, 19.0%; industrial organic chemicals, 18.9%; and plastics and resins, 18.2%.

Higher selling prices have had a marked effect on the profitability of the Canadian chemical industry. For the first nine months of 1979, sales by Canada's four largest publicly reporting chemical companies—Canadian Industries Ltd., Celanese Canada, Du Pont Canada, and Union Carbide Canada—were 26.5% higher than in the corresponding period of 1978. However, total net income for the four firms jumped 173.2%. The third quarter was particularly profitable.

For the first nine months of 1979, profit margins for the four firms

ranged from 4.4 to 7.6%, averaging a respectable 6.0%. In contrast, profit margins in the first three quarters of 1978 ranged from 1.7 to 4.0%, with an average of only 2.7%. The four companies expect that profitability will hold up well through the fourth quarter, but they're very cautious in their appraisals of 1980.

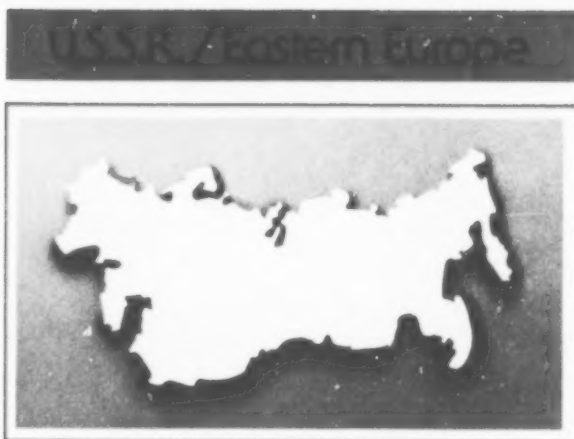
Particularly unsettling is the Canadian government's stated intention to increase domestic oil prices. How much the increase will be and how it will be carried out have yet to be revealed. But any sizable increase would wipe out the petrochemical industry's present competitive advantage in world markets. Petrochemical producers are urging special consideration for their industry. □

Production: growth is likely to slacken next year

Thousands of tons per year unless otherwise noted^a

	1976	1977	1978	1979 ^b	1980 ^b
Acetylene (mcf)	264.5	255.8	250.8	250	250
Ammonia, anhydrous	1530.5	2365.1	2583.1	2550	2600
Ammonium nitrate	1026.0	1019.4	985.9	1000	1000
Ammonium phosphates	1069.4	1264.7	1325.2	1500	1600
Benzene (lb)	2590.9	2741.1	3491.3	4500	5000
Caustic soda, 100% NaOH	1016.4	988.0	1142.2	1275	1200
Chlorine	990.2	979.2	1037.0	1125	1100
Ethylene	560.9	625.3	910.2	980	1000
Formaldehyde, 100% solids	67.3	73.0	80 ^b	90	100
Hydrochloric acid, 100%	120.7	150.2	170.4	170	180
Oxygen (mcf)	3806.5	4295.5	5474.3	5800	6000
Phosphoric acid, 100% P ₂ O ₅	576.0	554.7	563.2	750	800
Polyesters, unsaturated (mp)	40.5	46.1	44.7	60	60
Polyethylene (mp)	663.4	760.7	1052.7	1500	1650
Polystyrene (mp)	167.4	187.8	217.7	275	300
Polyvinyl chloride (mp)	213.3	219.8	275.0	325	375
Sodium chlorate	152.2	178.1	219.5	250	275
Sulfuric acid, 100%	3133.2	3461.6	3594.5	3500	3500
Urea	383.0	887.0	1341.7	1200	1300

^a mcf = millions of cu ft, lb = thousands of bbl, mp = millions of lb. ^b C&EN estimates. Source: Statistics Canada



Chemical growth slows in U.S.S.R., East Europe

The Soviet Union and its East European allies give high priority in their current five-year plans (1976-80) to the development of chemical industry. Much progress has been made. However, serious economic and industrial problems now besetting these countries also beset their chemical industries. The result is slower growth and failure in most cases to meet development goals—last year, this year, and probably for the five-year plans as a whole—with gloomy prospects for the 1980's as well.

The Soviet Union is the main supplier of raw materials and fuel to East Europe—furnishing, for instance, all East Germany's natural gas, more than 90% of its crude oil, and most of its iron ore and nonferrous metals. Energy investments and energy conservation campaigns are generally getting top priority. And all East Europe must worry about its petrochemical industry: Soviet oil—sold to it at less than current world prices—probably will reach a production peak in the next year or two and then rap-

Shortages of energy, transportation, and manpower and low productivity impede industrial development

Richard J. Seltzer, C&EN Washington

idly decline, according to Central Intelligence Agency (CIA) projections.

The Soviet bloc already has set up a basic chemical industry and will continue to develop it. But more attention will go to higher-value-added

chemicals such as specialty chemicals. For example, Romania's next five-year plan (1981-85) gives priority to specialized and fine chemicals, including pharmaceuticals (more than doubling 1980 output), dyes and pigments (up 60 to 80%), lacquers and paints (up 50 to 70%), pesticides (up 40 to 60%), detergents (up 80 to 100%), and cosmetics and perfumes (up 140 to 160%). To achieve this progress, East Europeans will try to acquire western technology.

Soviet and East European governments release only limited and selective data on their economic targets and results, and the figures must be regarded with caution. Nevertheless, it is known that the U.S.S.R. set a goal at the start of its current five-year plan of increasing chemical production 60 to 65%, or about 10.5% a year. This is the highest targeted growth for any Soviet industry.

However, according to CIA estimates, chemical production rose only 5.0% in 1976, 6.0% in 1977, and 3.1% in 1978. (These numbers are lower

Soviet Union's chemical output leads East Europe's by far

Thousands of metric tons in 1978	U.S.S.R.	Bulgaria	Czechoslovakia	East Germany	Hungary	Poland	Romania	TOTAL
Caustic soda (100%) ^a	2,764	102	309	415	154 ^b	463	800	5,007
Synthetic ammonia ^c	11,300	960	817	1193	756	1610	2227	18,863
Sulfuric acid (100%)	22,400	974	1195	972	689 ^d	3314	1619	31,163
Mineral fertilizers ^e	23,642 ^f	968	1176	4604	847	2621	2461	36,319
Nitrogen fertilizer ^g	9,200 ^f	685	625	885	533	1471	1715	15,114
Phosphate fertilizer ^g	6,085 ^g	283	367 ^g	413 ^g	184	1026	682	9,040
Potassium fertilizer ^g	8,350 ^f	—	184 ^h	3306	130 ^h	124 ^h	64 ^h	12,158
Plastics	3,517 ⁱ	177	810	753	213	471	552	6,493
Synthetic rubber	1,795 ^j	25	59	155	—	126	147	2,307
Synthetic fibers ^k	483	45	85	128	19	158	134	1,052

^a Including tonnage used on site for processing. ^b Including regenerated caustic soda. ^c Nitrogen content. ^d Including oleum. ^e On basis of nutrient content (N, P₂O₅, or K₂O, respectively). ^f Including some product used for technical purposes. ^g Including production of ground phosphate rock for direct application and phosphate animal feeds. ^h Imported potash added to domestically produced nitrogen and phosphate to form multinutrient fertilizer. ⁱ Including resins for man-made fibers. ^j Estimated. ^k Data for noncellulosic fibers made of either synthetic or natural polymers (for example, based on casein or groundnuts); data exclude waste, glass fibers, and rubber fibers. Source: Central Intelligence Agency

than official Soviet figures—7.8% in 1976 and 6.9% in 1977, for example—but CIA considers the Soviet figures to contain an upward bias.)

Development in 1979 is falling even farther behind target. Official Soviet figures show that overall industrial production through October grew only 3.6% (the goal for the year is 5.7%). Chemical industry output through September grew only 1% and was 5% short of the plan for nine months. And production through October of such key chemicals as fertilizers, plastics, synthetic fibers, and pesticides lagged behind even 1978 levels for the same period.

Chemical output is slated to rise 9% in 1980. However, Soviet planners already have signaled that the five-year plan goals for 1980 will not be met for most chemicals. For example, fertilizer production will reach only 98.3 million metric tons this year, barely more than last year's 98.0 million and far short of the goal of 111 million. The 1980 target is 115 million, up 17% from 1979 but 20% short of the five-year goal of 143 million.

Other East European countries show similar shortfalls. For instance, East Germany's five-year plan aims to increase overall industrial output 34 to 36%. The chemical industry is to grow much more, 44 to 46%. A rise in labor productivity (34 to 36%) is to account for much of the growth, a common objective in East Europe. However, CIA figures show an increase of only 11% in industrial production between 1975 and 1978.

Chemical industry output for the first half of 1979 also lagged behind target, according to East German statements. There were shortfalls for polyvinyl chloride (down 3.5% compared to the first half of 1978), and man-made fibers (down 2.3%).

Both Czechoslovakia and Hungary had mixed economic results in 1978, and have scaled back targets for this year and next. Czechoslovakia's chemical industry had better results last year than some other sectors, with output up 5.5%, according to official statistics. Polyethylene output grew 25%, polyvinyl chloride and copolymers 8%, and synthetic fibers 7%. The chemical industry led all Hungary's industries in growth last year, with production up 10.7%.

Bulgaria fell short of many plan targets last year. Chemical output grew 10% (the plan was 11.1%), with sulfuric acid production up 14%. However, fertilizer production dropped 1.6% below that for 1977.

Meanwhile, Romania—with the fastest growing economy in East Europe—fell short of targets in major areas last year, although still making considerable progress. Faced with growing manpower and energy constraints, it will have difficulty duplicating its double-digit industrial growth rates in the early 1970's. Industrial production rose 9% last year, according to official figures (6% by CIA estimates). However, the target was 10.6%. Chemical production—a top priority and slated for 160 to 180% growth in 1976–80—grew 10.1% but the target was 15.2%.

The 1979 plan still ambitiously calls for growth of 11.3% in industry overall and 18.3% in chemical production. And the next five-year plan (1981–85) targets an average annual growth rate of 9.0 to 9.8% for chemical

industry (with plastics output up 50 to 70% between 1980 and 1985, synthetic fibers and yarns up 60 to 80%, and synthetic rubber up 40 to 60%). But Romania—an oil importer since 1976—is depleting its oil reserves.

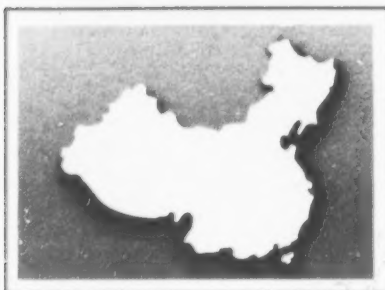
Poland's economy is in the worst shape of all in East Europe. After dynamic growth in the early 1970's—running up large hard currency debts—Poland has had to curb growth, investment, and acquisition of foreign technology. Production of key chemicals lagged in 1978 (sulfuric acid up only 1.4% from 1977, fertilizers up 0.4%, and plastics up 1.7%).

Poland is focusing on consolidating and modernizing existing facilities, and trying to overcome structural problems similar to those plaguing all Soviet-bloc industry: inadequate transportation; insufficient fuels, energy, and raw materials; labor shortages; low productivity; poor product quality; poor industrial management; outmoded technology and equipment; and long delays in completing construction projects. □

Soviet chemical output seems sure to miss 1980 targets

Millions of metric tons unless otherwise noted	1979		1978		1977		1980 original target ^a
	Plan	10-month Result	Plan	Result	Plan	Result	
Mineral fertilizers^b	111	78.5	101.5	98.0	98.5	96.8	143
% increase ^c	13.3%	-4% ^d	4.9%	1.2%	6.7%	5.0%	9.8% ^e
Synthetic resins & plastics	3.8+ ^f	2.9	3.6	3.5	3.4 ^f	3.3	5.4–6.0
% increase ^c	8.6% ^f	-1% ^d	9.1%	6.1%	12.7% ^f	7.3%	13.7–16.0% ^e
Chemical fibers & yarns	1.20 ^f	0.91	1.14	1.13	1.10	1.09	1.45–1.50
% increase ^c	4.6% ^f	-2% ^d	5.2%	4.0%	7.8%	6.7%	8.7–9.4% ^e
Automotive tires^g	na	49.9	60.1	59.0	57.3	57.4	70–72
% increase ^c	na	2% ^d	4.7%	2.8%	5.1%	5.3%	6.2–7.0% ^e
Pesticides & herbicides^h	na	401	na	492	489	487	615
% increase ^c	na	-2% ^d	na	1.0%	7.2%	6.8%	7.0% ^e
Soda ash (100%)	na	na	na	4.9 ^f	5.1	4.9 ^f	na
% increase ^c	na	na	na	-0.4%	6.2%	2.1%	na
Caustic soda (100%)	na	na	na	2.8	2.8	2.7	na
% increase ^c	na	na	na	3.7%	7.7%	3.8%	na
Sulfuric acid (100%)	na	na	na	22.4	22.5	21.1	na
% increase ^c	na	na	na	6.2%	12.5%	5.5%	na

^a As planned at start of Five-Year Plan in 1976. ^b Conventional units. ^c Increase or decrease from result in previous year. ^d Increase or decrease from 10-month result in previous year. ^e Calculated average annual increase required in 1976–80 to reach original 1980 target. ^f Approximate. ^g In millions of units. ^h In thousands of metric tons. ⁱ 1978 total of 4 058 million metric tons was actually lower than 1977 result of 4 876 million. ^{na} = not available. Sources: U.S. Department of Commerce and Department of State.



China, overextended, sets new growth plans

China is continuing the economic and industrial growth—and the pragmatic overturning of previous economic and political taboos—that it began in 1977, following a decade filled with political and social upheaval that devastated its economy, science, and education. However, this year China found itself to be overextended, running head on into the structural limitations of its underdeveloped industrial and educational system. It therefore has scaled back and restructured its plans to enable slower, more balanced, and more selective development.

This "readjustment" policy will continue for three years, 1979–81, and lay the basis for more rapid growth under the next five-year plan (1981–85). The policy puts more emphasis on agriculture and on light and textile industry (producing for long-neglected consumer needs and for export) and relatively less emphasis on heavy industry. Within heavy industry, it stresses strengthening of "weak links" inhibiting all development—particularly coal, oil, electric power, transportation, communications, building materials, and non-ferrous metals. And top priority goes to projects "that need less investment, produce quick returns, and earn more foreign exchange."

Moreover, the policy will push for thoroughgoing reform of industrial management, with stress on economic criteria, quality control, worker incentives and discipline, productivity, energy conservation, and training of management and workers. And there is a further looking outward—seeking compensation trade and foreign loans, and joint ventures.

China is now also more open about releasing economic data, for the first time since 1959—although still far from western practices. Official figures show that overall industrial

Balanced, selective industrial development sought, top priority to synthetic fiber and fertilizer expansion

Richard J. Seltzer, C&EN Washington

production rose 14.3% in 1977 and 13.5% in 1978, both exceeding plan targets. In 1979, the readjusted goal is lower—just 8%, including 8.3% for light industry and 7.6% for heavy industry. After a slow start, the Chinese expect to meet these targets. Through

October, production was 7.4% more than in the first 10 months of 1978.

Chemical industry priorities follow the national plan's emphasis on agriculture and textiles. Fertilizer production grew 66% between 1976 and 1978, to 8.69 million metric tons (on a 100% effectiveness basis). Output is slated to rise 10% this year, but production through October was already up 20% from the same period last year. Increased nitrogen fertilizer capacity is the main reason, as the 13 large ammonia-urea complexes purchased from abroad and small-scale plants have come on stream. However, large imports are still needed. Current plans are to build at least nine more ammonia units, each of 1000 metric-ton-per-day capacity, notes John C. Marshall of Contractors John Brown Ltd., London.

Meanwhile, synthetic fiber production is soaring, up 95% between 1976 and 1978. It is slated to rise only 5.3% this year, to 300,000 metric tons, but capacity under construction is expected to at least quadruple output.

The Chinese look to large imports of foreign technology and equipment as crucial for rapid expansion of their chemical industry, as well as other industries. Indeed, Marshall calls China "the last great market for the industrialized nations." However, by all accounts, the Chinese will build up production and reduce product imports as quickly as possible. And because of China's political and social system, western producers of consumer goods should base no dreams on its population of 1 billion.

China's total foreign trade last year jumped to \$21.2 billion (\$10.1 billion exports and \$11.1 billion imports) from \$15.1 billion in 1977. It is expected to reach \$29 billion this year (\$12 billion exports and \$17 billion imports), according to U.S. Commerce Department estimates. About

Fibers lead rapid rise in China's chemical output

Thousands of metric tons	1978	1977	% '78-'77
Chemical fertilizer ^a	8693	7236	20%
Sulfuric acid	6610	5375	23
Caustic soda	1640	1386	18
Soda ash	1329	1077	23
Plastics	679	524	30
Insecticides	533	457	17
Ethylene	380	303	26
Synthetic detergents	324	257	26
Chemical fibers	285	190	50
Pharmaceuticals	41	35	16

^a On 100% effectiveness basis. Source: State Statistical Bureau of People's Republic of China

85% of last year's trade was with noncommunist countries.

During the past eight years, China has bought nearly 150 chemical units, worth more than \$4.8 billion, according to the National Council for U.S.-China Trade. China says it will spend \$3 billion this year for technology and complete plants for chemical and other industries. And world sales to China of technology, equipment, and plants for all industries are projected at \$40 billion between 1979 and 1985.

With political bars removed through diplomatic normalization early this year, U.S. trade with China in 1979 is expected to reach \$2 billion, up from \$1.1 billion in 1978. U.S. exports—mostly agricultural products—will make up \$1.5 billion to \$1.6 billion of this. This is still far below China's trade with Japan (\$5.1 billion last year), and Japan is well positioned for further trade expansion. However, U.S.-China trade is expected to grow to \$5 billion or more a year by 1985.

Of \$1.26 billion in U.S. exports to China through October this year, \$87.8 million worth was in chemicals. (There also were considerable chemical exports through foreign affiliates of U.S. firms, not included in U.S. figures.) Moreover, not counted in

this "chemicals" category are such things as chemical technology and equipment, and large amounts of synthetic fibers—for example, \$47.1 million of polyester fiber (noncontinuous form) through October.

U.S. chemical exports to China have expanded very rapidly. The \$87.8 million for the first 10 months of this year is almost double the \$46.4 million exported during the like period of 1978. The U.S. sold China \$60 million worth of chemicals in all 1978, \$20 million in 1977, and \$10 million in 1976. The National Council for U.S.-China Trade projects annual U.S. chemical exports and imports of \$350 million each by 1985.

Agricultural chemicals—particularly nitrogen fertilizers and insecticides—and resins top the U.S. export list. For example, \$20.7 million worth of urea, \$18.2 million of polyester resin, and \$4.9 million of organophosphorus insecticides were sold in the first 10 months of 1979.

U.S. chemical imports from China totaled \$44.9 million in the 10 months through October 1979 (up from \$26.1 million in the same period a year ago), out of total U.S. imports from China of \$458.5 million. This includes \$6.8 million worth of menthol and \$13.3 million of fireworks. Indeed, fireworks, categorized as a "chemical," is

currently the second highest U.S. import from China, exceeded only by crude petroleum (\$55.7 million).

Congress is expected to approve soon a U.S.-China trade agreement extending most-favored-nation tariff treatment to China and providing for some patent and copyright protection (no full protection as yet in China). Most-favored-nation status will reduce some chemical tariffs. For example, the tariff on pharmaceuticals will drop from 10% to 1.5%, and on menthol from 50 cents a lb to 17 cents. However, Commerce Department analysts do not expect this to have much impact on Chinese chemical sales, because Chinese prices are already competitive.

Nevertheless, large imports from China already have caused problems for U.S. textile producers, and the U.S. has imposed quotas unilaterally after failing to reach agreement with the Chinese. Menthol imports are also worrying U.S. producers (some firms are talking about possible "dumping" charges). And a Commerce Department list cites other chemicals that China exports whose U.S. producers might be affected by increased imports: benzenoid drugs, aromatic compounds, sodium acetate, camphor, carbonates, borates, sulfates, and antimony oxide. □

Chinese chemical capacity will soar over next few years

Thousands of metric tons	1978	Planned ^a	Thousands of metric tons	1978	Planned ^a
PETROCHEMICALS					
Ethylene	490	2110 + 1157 ^b	Epichlorhydrin	na	55
Low-density polyethylene	240	300 + 2807 ^b	FIBERS AND INTERMEDIATES ^c		
High-density polyethylene	35	455	Acrylonitrile	75	75
Vinyl chloride	na	400	Acrylic fiber	35	35
Polyvinyl chloride	40	480	Nylon 66	50	65
Ethylene glycol	60	60	p-Xylene	64	na
Acetaldehyde	30	180	Terephthalic acid	na	475
Ethanol	na	200+	Dimethyl terephthalate	90	90
Methanol	na	100	Polyester chip	130	860
Polypropylene	115	115	Polyester fiber	180	180+ ^c
Butadiene	45	120	FERTILIZERS		
Aromatics	na	600	Ammonia (as product)	4620 ^d	6270 + 9907 ^b
Phenol	na	50	Urea (as product)	7050 ^d	7620 + 5607 ^b
Oxo alcohols	na	140	Phosphates (as P ₂ O ₅)	1500-2000	2500 ^e
Methylenediphenyl isocyanate	na	10	Potash (as K ₂ O)	300-350	500 ^e

a Estimated by summing current capacity, capacity now under construction, and apparently firm announcements of construction plans. b Question mark indicates capacity possibly planned, rather than firmly committed. c Figures are believed to understate current and future fiber capacities, especially future polyester fiber capacity. d Includes only 13 large ammonia-urea complexes purchased from abroad; excludes smaller plants. e By 1980. na = not available. Source: John C. Marshall, Constructors John Brown Ltd.

Middle East



Middle East lays a petrochemical groundwork

The Middle East appears set to become a major source of petrochemicals in the coming decade. Opinions differ, however, about the magnitude of the effect on established producers in Western Europe and elsewhere.

"The increasing involvement of the Middle East in the European petrochemical scene is likely to be one of the most significant happenings of the next decade," observes Stuart H. Wamsley, chemical industry marketing analyst with Hedderwick Stirling Grumbar in London. "With European growth rates likely to be on the low side, it will be up to western and Middle Eastern producers to take all possible steps to ensure that common sense prevails."

On the other hand, Tony Church of Kidder Peabody's London office states, "In our opinion, Middle East exports, once they begin to arrive in West Europe, will not cause massive disruption. We believe that the Middle East threat will materialize only over a much longer term and even then will be less severe than expected, provided West European attitudes soften and the Middle East position does not harden."

Notes Anthony Lowe, head of planning and economics at Shell International Chemical, "Having regard to the difficulties of construction in many oil-producing countries, many feel that [they] would do well to achieve 5% of world petrochemical production by 1990. The growth of the share of the world industry held by oil-producing countries will increase steadily in the next few years. But it will take longer to reach its ultimate share than was originally thought possible."

Cost of building plants in the Middle East is high, and their impact on world markets is still far from clear

Dermot A. O'Sullivan, C&EN London

Chemical manufacturing is not new to the Middle East. Israel, for instance, already has a highly sophisticated and diverse chemical industry. A number of the countries have been making inorganic chemicals, as well as nitrogen fertilizers from natural gas, for some time. What has caught the attention of the West has been the widely proclaimed intentions of some countries to make a variety of petrochemical intermediates and downstream derivatives.

In the case of Qatar, these plans already have taken concrete shape. Qatar General Petroleum Corp., in partnership with CdF Chimie of France, is well along in putting up a cracker at Umm Said. Qatar Petrochemical Corp. (Qapco), the name of the venture, will use ethane separated from Qatar's plentiful supplies of

natural gas liquids as feedstock. Ethylene will go to make low-density polyethylene. Both units are scheduled to start up late next year.

The cracker will be able to make 616 million lb of ethylene annually. This will be more than enough to supply the 308 million lb-per-year LDPE unit, which is expected to reach full capacity in 1982. Studies are under way on various options to utilize the uncommitted ethylene in a profitable manner, Qapco says. Meanwhile, CdF Chimie, which is providing process know-how for both plants and is training people to operate them, will market the LDPE through its existing sales outlets.

Perhaps taking a leaf out of Qatar's book, Saudi Arabia, too, is aiming to get into petrochemicals with outside partners, though on a very much larger scale. Agreements on two projects already have been signed. Discussions still are under way on projects involving Celanese and Texas Eastern, Dow Chemical, Exxon, Mobil, Shell Oil, and a group of Japanese companies. All but one of the operations are slated to go in at Al-Jubail, on the Persian Gulf.

During the past month, Saudi Basic Industries Corp. (SABIC) signed an agreement with a group of Japanese companies comprising C. Ito, Mitsubishi Gas, and others to build a 1.3 billion lb-per-year methanol plant. And with Taiwan Fertilizer Co., state-owned SABIC will put up a 1.1 billion lb-per-year urea plant. Both are expected to be ready for operation by 1984.

According to Abdullah S. Nojaidi, SABIC's marketing manager, talks are well along with the other com-

panies. He expects the first contracts to be signed early next year.

Methane and ethane will be separated from the country's oil-well gas. The methane will be used to make methanol and urea, the ethane will go to the crackers. As plans now stand, some ethane will be piped the 700 miles or so west to Yanbu, where it will feed a cracker Mobil is contemplating next to a projected 250,000 bbl-per-day refinery it may build with Petromin, the Saudi state-owned oil and minerals organization.

Nojaidi says the partners in the various schemes will take the bulk of the products and channel them into the world market. He also appears confident that all of the projects will be operating before 1984.

This seems overoptimistic, since final commitments for most of them haven't been made formally. Moreover, building such complex plants involving, highly sophisticated equipment and instrumentation, won't be easy in view of Saudi Arabia's severe climate and generally poor infrastructure system. These problems may be partly circumvented by prefabricating sectional units of the plants elsewhere.

The cost, obviously, will be considerable, more than it would be to build the plants in Europe or the U.S. At a Society of Chemical Industry meeting in London last month, Len R. Burchell, BP Chemicals' managing director, provided some rough estimates of what the cost differential might be.

In Western Europe, a 1.1 billion lb-per-year (of ethylene) cracker, together with plants for making the usual range of downstream products, would cost about \$2.6 billion, he says. This would include \$1.5 billion for materials and \$900 million for labor. For a similar complex in the Middle East, according to Burchell, the figure would be closer to \$4 billion—\$2 billion for materials and between \$1.5 billion and \$1.9 billion for labor. Somewhat offsetting the differential, of course, is low-cost feedstock.

"Another factor weighing against Middle East production is the cost of bringing material to Europe," Burchell adds. "Building a plant in the Middle East rather than in Europe will be justified if the cost differential

Saudi Arabia has ambitious petrochemical plans

Capacity, millions of lb per year	Foreign partners					Various Japanese partners	Taiwan Fertilizer
	Dow Chemical	Mobil	Shell Oil	Exxon	Celanese/Texas Eastern		
Ethylene	1100	990	1443	—	—	990 ^a	—
Ethylene dichloride	—	—	999	—	—	—	—
Ethylene glycol	660	440	—	—	—	—	—
Ethanol	—	—	618	—	—	—	—
Polyethylene, low-density	154	440	—	528	—	—	—
Polyethylene, high-density	231	200	—	—	—	—	—
Methanol	—	—	—	—	1540	1320 ^b	—
Styrene	—	—	649	—	—	—	—
Urea	—	—	—	—	—	—	1100
Sodium hydroxide	—	—	829	—	—	—	—

^a Mitsubishi Chemical, Mitsubishi Petrochemical, and others. ^b C. Ito, Mitsubishi Gas, and others. **Note:** All of these proposed projects will be in partnership with Saudi Basic Industries Corp. **Source:** Saudi Basic Industries Corp.

between transporting gas to Europe on the one hand, and transporting products on the other, is more important than the differential in construction costs in the two areas." Burchell hastens to add that these are generalized conclusions.

In Iraq, Lummus is building a complex that is expected to be ready next year. The 308 million lb per year of ethylene potentially available will be used to make low- and high-density polyethylene and polyvinyl chloride.

In Kuwait, state-owned Petrochemical Industries Co. has completed feasibility studies that, the company expects, will lead to two complexes by 1985. One will be centered on 770 million lb per year of ethane-derived ethylene. This will go to make LDPE (286 million lb-per-year capacity), glycol (297 million lb per year), and styrene (715 million lb per year). An aromatics complex should be capable of producing 625 million lb of benzene, 132 million lb of *o*-xylene, and 189 million lb of *p*-xylene yearly.

A nagging worry in the back of most people's minds right now is concern about the future political stability of the Middle East.

B. F. Goodrich was one of the first companies to suffer. Abadan Petrochemical Co., a joint venture of Goodrich and Iranian National Petrochemical Co., was nationalized. The operation makes raw materials for detergents and plastics.

Du Pont, too, has been hard hit. Polyacryl Iran Corp. (PIC) closed its plant at Isfahan late last year, within months of startup. The company, in which Du Pont has a 40% stake with private Iranian interests owning the balance, had an annual capacity of 40 million lb of acrylic fibers and 60 million lb of polyester fibers.

In response to a Du Pont petition, U.S. District Court judge Richard Owen late last month issued an order of attachment against the state of Iran and PIC for \$93 million. The sum includes \$62.8 million in loss of equity and reasonable return, according to Du Pont, and \$10 million in loss of anticipated dividends.

Nor can the Japanese be happy with their Iranian experience. The biggest project, and the one in most serious financial trouble, is that of Iran-Japan Petrochemical Co. It is a joint venture between Iranian National Petrochemical and a group of Japanese companies, the largest share belonging to Mitsui.

At Bandar Khomeini (formerly Bandar Shapur), Iran-Japan Petrochemical is putting up a major complex based on a naphtha cracker with a design capacity of 660 million lb of ethylene per year. A host of downstream product units are part of the scheme. The project is far from finished, although it had been expected to be ready this year. It will take a lot more money on top of the many millions already spent there to see it through. □